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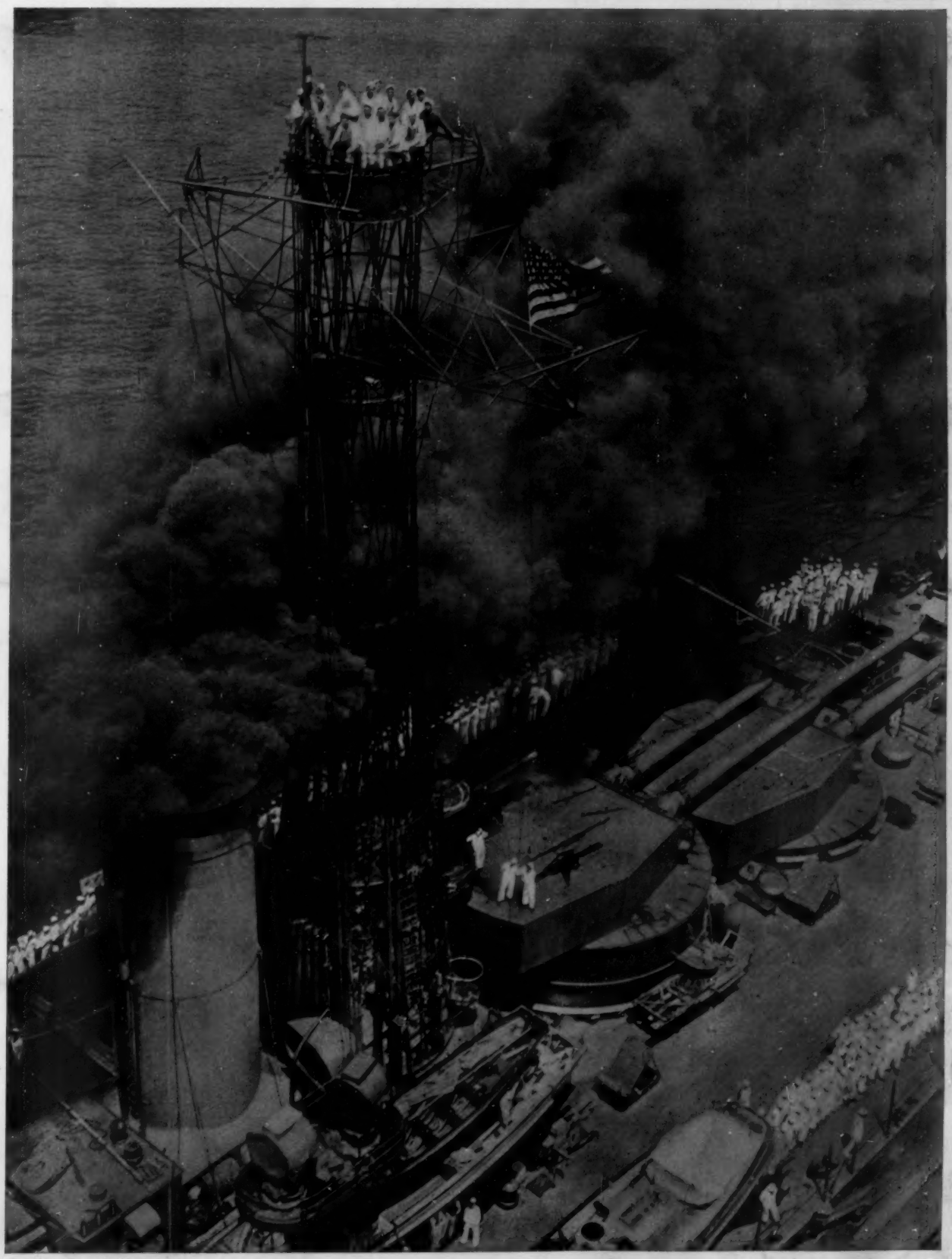

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BIRD'S-EYE VIEW OF THE DECK OF THE U. S. BATTLESHIP "WYOMING," SHOWING THE MILITARY MAST AND HER AFTER TURRETS WITH 12-INCH GUNS.—Photographed from a tower of the Manhattan Bridge, New York.

Vol. CXIII. No. 17
October 23, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIII. NUMBER 17

NEW YORK, OCTOBER 23, 1915

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Typical low water view along the banks of the upper Quequechan, strewn with refuse

Low water view of lower end of Quequechan River, showing the unsanitary exposed flats

Fall River's Proposed Water Supply System

THE highly industrial city of Fall River, Mass., is to-day confronted with a proposed plan for one of its public improvements that will involve a cost of $3,000,000. Although the plan has not yet been actually approved by the city government, the uniqueness of the project from an engineering viewpoint draws great interest to it.

The Fall River project has to do with the improvements of the Quequechan, a little stream that runs through the heart of the municipality. This stream is the outlet of a large lake and the industrial water supply to many mills; it falls more than 100 feet in its course of less than 2 miles and, from beginning to end, it is a business brook.

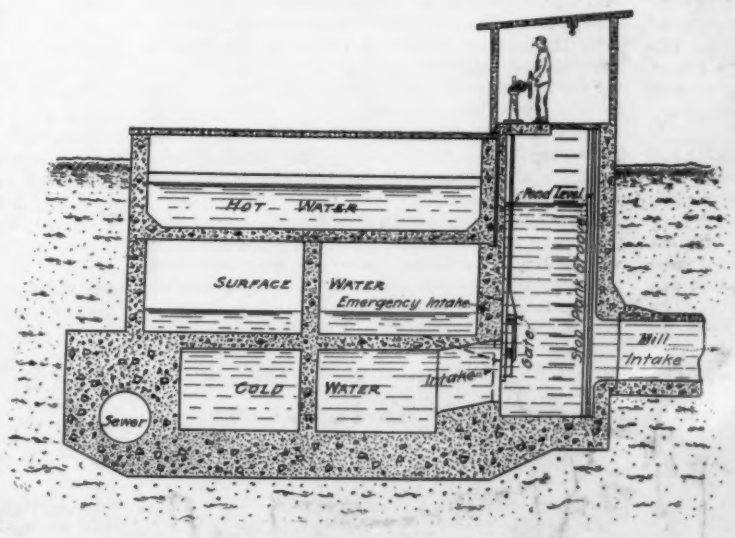
Watuppa Pond was in Indian and Colonial times the largest body of fresh water in Massachusetts. It has been divided into two parts and the city of Fall River draws its drinking water from the north pond, while the south pond furnishes industrial water for the mills along the Quequechan. Under rights which antedate the formation of the Commonwealth of Massachusetts, a private corporation controls the water in the south pond and its tributaries, the flow through the Quequechan, drainage rights on the watershed of the stream and flowage rights along the banks of the little river.

The city in using the north pond for its domestic supply does this with the limitation that the mills may not suffer for water. It is stipulated that the level of the north pond shall follow that of the south pond to within 1 inch. There is a minimum at about 4 feet below full pond level, where the north pond may be conserved. The result of this bargain is that the city is debarred from the usual and necessary conservation practices of reservoirs for domestic use. It is not permitted to reserve the excess precipitation of one season for use in a dry time, which is good common sense, for in the interim the mills have needed the water and it has been drawn off through the south pond. The city has at great expense sought to preserve the purity of its supply by reservations along the shores and spends money to divert contaminated sources from its reservoir. Yet on demand it must deliver a billion or more gallons of this precious water each year for the uses of the mills in their work.

A second bargain made nearly a century ago with the same controlling corporation affects the flowage rights along the shores of the stream. The filling of the land is under restrictions and at considerable cost to the owners, so that very little if any reclaiming of the flats of the Quequechan has been done.

The care of the Quequechan has been conspicuous generally by its absence. Along its banks are located something like fifty mill buildings belonging to about thirty companies. The mills draw water for use in the condensers of their engines—and for other industrial uses—and discharge it again into the stream, which in summer by constant use touches a temperature of 140 deg., and is consequently unfit for condensing purposes.

Many of the mills have no connections with the sewer system of the city and use cesspools, the overflow from which, at least, comes into the river. The surface drainage of the district, 2 or 3 square miles of which is the residential section for Fall River, is divided. Some of it comes into the stream without apology, while in other places it is directed into the sanitary sewers.



Cross-sectional view of the proposed Fall River triple-conduit structure

These, however, have not the capacity to care for the quick run-off of so large an area, so that they have storm-water outlets into the river. Then in one place at least, a sewer comes frankly into the stream, and then again at various points outhouses have overhung the banks, but this nuisance has in part been abated since evidence in the way of photographs presented conditions as they are. To add to the discouraging situation the flats and the stream have been used without authority for the quiet disposal of refuse, the presence and amount of which the illustrations clearly indicate.

The result of such a group of unfortunate circumstances has been a contaminated river which has attracted the attention of the State Health Department. Flats are regularly exposed in times of low water, as the illustrations show, in places with unsightly levels of black mud or covered with the rank vegetation which the "ripeness" of the soil favors. The proximity of the brook to the residential section has made it a resort for boy and men bathers, the warm water conducing to bodily comfort.

Neglect of the Quequechan has resulted in another phase of Fall River's difficulties, namely, that the silt of surface drainage and other debris has so filled the valley bottom that the bed of the stream has been elevated. The outlet from the lake is over a bar, and it is true that the actual amount of water flowing in the stream is less than it was a century ago.

It may be seen that the situation is very complicated. The State Health Department is moving towards the abatement of the nuisances of the Quequechan, and this must infallibly be done. The municipality is beginning to realize that with its growth in population continued for another five years, it will face a water famine in any subsequent dry season.

The state, further, is refusing to allow the surface drainage of the valley to enter the south pond, so that there is enforced the necessity of providing means of running if off to tide water. This drainage is eventually for an area of 5 miles of hillsides rising in one half a mile to 100 feet above the stream. With houses and streets this will mean a rapid run-off and for an ultimate quantity in a heavy storm of hundreds of millions of gallons a day.

This was and is the general situation in Fall River, and the citizens through legislation secured the appointment of the Watuppa Ponds and Quequechan River Commission, with wide scope and large powers, hoping through it to solve the problems. The Commission somewhat more than a year ago retained Fay, Spofford and Thorndike of Boston for consulting engineers, and the plans have been evolved in the comparatively short interval. The report was required by law to be in the hands of the City Council on October 1, and it was made public by consideration at the session of this body on October 4.

The features of the plan for getting rid of all the difficulties at once include for the central item a great, three-way conduit, the channels being one above another like the floors in a house. In fact, it might be described as a big factory structure of reinforced con-

(Concluded on page 366)

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Nature as a Canal Builder

IN spite of the noble achievements of the civil engineer, he is, in the last analysis, but a child toying with the forces of nature. So long as he "plays the game," obedient to her laws, nature is complaisant; but should he break them, delay and discouragement, if not dire disaster, will surely follow. One of the finest poems ever written came, if we remember rightly, from the pen of an engineer, who describes the San Francisco earthquake as the result of a momentary fretfulness of Mother Earth, who, irritated at the scratching of her skin by the excavating, boring, tunnelling, and building activities of man, shook herself and flung down a whole city in ruins. The dramatic imagery of the poet was not so very far from the truth. It was a very slight movement of Mother Earth in the endeavor to find a more comfortable position of repose that brought about the San Francisco disaster.

All of us, at one time or another, have watched a little child, wooden spade in hand, trying to dig a pathway through a pile of dry sand. As each tiny spadeful disturbed the quiet of the mass, the sand streamed in to fill the void. If the little chap be patient and determined, and digs until the level of the beach is reached, he must do so until the loose sand ceases to slip down the sides of his "cutting," and the sides thereof have found what engineers term "the natural angle of repose."

As in the less, so in the greater. We, children of earth, have now for over a decade been digging a pathway for our shipping through the unstable and heterogeneous material of the Isthmus of Panama. For the greater part this material consists of the mud-like deposit which was formed at the bottom of the sea while the Isthmus was under water. When the strip of land which we call Panama was raised by volcanic action above the surface of the sea, the underlying molten rock broke through in places, throwing this marine layer out of its stratified orderliness into a confused jumble of hills and valleys, through which the igneous rock here and there boiled up and finally solidified in place.

When the canal builder came with his dynamite and steam shovels and proceeded resolutely to open a huge excavation through the mass, he encountered a wide variety of material. The igneous rock remained securely in place, despite his blasting and digging; but the remainder, consisting chiefly of this dried mud (for it is little else), showed but little stability, and in many places flowed into his cutting with the same persistency with which the sand rolls in upon the wooden spade of the child as he digs upon the ocean shore.

As matters stand to-day, everywhere throughout the 50-mile length of the Panama Canal, Nature's angle of repose of the banks has been reached, and the work is permanent and stable. The only exception (and it is a mighty big and troublesome one) is found at the great Culebra Cut, now called the Gaillard Cut in honor of the engineer who gave his life in the work. Here the cut is carried through the mountain divide. At the highest point, known as Gold Hill, where the depth of the excavation is over 500 feet, was found one of those masses of hard, igneous rock resulting from the volcanic upheaval when Panama was formed. Where the Canal passes through this rock the sides of the cut are stable and will remain so forever; but on each side of Gold Hill, north and south, is a mass of plastic material (called "rock" by the engineers before they cut into it, but now frequently spoken of as mud) which is 250 feet in depth against the rock of Gold Hill and diminishes in depth along the Canal as it follows the slope of the divide toward the Pacific and the Atlantic.

When the survey and preliminary plans for the Canal were made, it was believed that this plastic material would stand at a slope of 1 vertical to 2 horizontal. As the cut went deeper and the sides of the slope grew more lofty, the material on both sides of the Gold Hill rock refused to stand at the slope demanded. The lower strata would be crushed and disintegrated under the enormous load of the superposed material; or great cracks would occur at the surface, parallel to the Canal and often several hundred feet back from the edge of the cutting, to be followed, sooner or later, by the gradual flow of the whole mass into the Canal prism.

The Cucaracha slide, lying to the south of Gold Hill, and the Culebra slide, to the north of it, have become familiar terms. Both of these have proved troublesome throughout the whole of the period covered by the building of the Canal; but at the time of its opening they appeared to have been mastered and to have become quiet. The SCIENTIFIC AMERICAN suggested, when the water was admitted into the cut, that possibly the softening of the bottom 40 feet of depth at the toe of the slides, by the infiltration of the water, coupled with the heavy rains of the rainy season, would set them in motion, possibly in enormous volume. And this is what has happened, first at Cucaracha, and now on a staggering scale to the north of Gold Hill, in a slide which reaches 1,400 feet along the channel and extends several hundred feet back from the edge of the Canal. The total area covered has been stated to be 175 acres, and the total amount of material in motion, according to Washington dispatches, is 10,000,000 cubic yards.

It has been found that the natural angle of repose which Nature demands is 1 to 7; and this indicates that there is nothing for it but patiently to dredge out the material until this angle has been reached. The Canal has been closed indefinitely, and Col. Goethals has recalled his resignation and returned to take charge of the work until this problem, at once simple and prodigious, shall have been definitely mastered and any chance of further sliding removed.

A Laboratory—Not a Navy Yard

THE latest information from the office of the Secretary of the Navy regarding that excellent scheme for creating a civilian Consulting Board of Inventions, indicates that the matter is in danger of being wrecked by the grandiose scale on which it is being carried out. When the proposal was first made public we gave it our hearty endorsement, believing that if the scheme included the building and equipment of a research laboratory, in which the more meritorious of the inventions could be tested—at least as to the soundness of their underlying principles—the Board of Inventions could render very efficient aid in the development of new materiél for the navy.

In advocating the building of this laboratory we were mindful of the fact that the Navy Department has already at its disposal some highly efficient plans and apparatus, such as the model basin at Washington and at Ann Arbor, the wind tunnel at the Massachusetts Institute of Technology and other experimental apparatus of a similar character, suitable and available for the investigation of naval problems. What we had in mind was the construction of a laboratory for physical and chemical tests, with possibly a few machine shops of modest dimensions and sufficient equipment for testing out inventions through models built to scale.

The plan as outlined at an all-day session of the Naval Consulting Board, however, calls for the creation not of a laboratory but of a navy yard, with docks capable of accommodating a modern dreadnought and with a marine railway large enough to build experimental submarines of 1,500 tons. The whole establishment, as proposed, is to cost some $5,000,000 and is to be operated at an annual expenditure which may run up to $3,000,000.

Now, it seems to us, and we believe that the opinion will be backed by every naval officer who has had experience in the construction work of the navy, that in an experiment of this kind (and in the last analysis it is nothing more than an experiment) the work should be allowed to proceed by a natural process of growth. If the laboratory of modest proportion which we have in mind proves to be a success, and if the number of useful inventions selected by the Board proves to be sufficient to warrant an enlargement of the plant, well and good; but in this, as in every other new departure, we must learn to walk before we can hope to run. In commercial life a $5,000,000 plant would mean a $10,000,000 corporation, and no body of hard-headed business men would ever think of putting that amount of capital into a venture which had so little of precedent and so much of theory to back it as this ambitious and grandiose proposal. The fundamental idea underlying the Consulting Board is excellent, but the way things are going, it looks as though the scheme were in danger of being killed by the kindness of its friends.

Benzol for Gasoline as Motor Fuel

WITH the fine flair for news of a sensational character that distinguishes many of our metropolitan newspapers, prominence has been given to a statement made by the president of the National Aniline and Chemical Company with regard to the substitution of benzol for gasoline as the motive power for automobiles. The occasion was a regular meeting of the New York Section of the American Chemical Society, at which Mr. Stone delivered an address on "The Status of the Chemical Industries in the United States at the End of 1915."

Prior to the outbreak of war in Europe most of the by-products of American coke plants were either wasted or shipped to Europe for conversion into benzol and carbolic acid, as well as for the manufacture of a long list of so-called benzene derivatives, including the intermediate and finished compounds of aniline used in the dye industry. As a consequence, the managers of many highly scientific industries in the United States, which were dependent on Europe for supplies of basic coal tar products, found themselves, right after the beginning of the war, in a position where stress of necessity would compel them to utilize certain by-products of the coke plants, hitherto wasted or sold for an unremunerative price to foreign refiners.

Thomas A. Edison was among the first to feel the pinch of necessity, carbolic acid being an important ingredient in the manufacture of recording disks and cylinders. Mr. Edison knew that in Europe carbolic acid was profitably made from benzol and that there were unlimited amounts of this base ready for utilization at the coke plants, if suitable machinery could be devised for the treatment of the coke waste. Applying himself to the problem with characteristic energy, in a few weeks time he had surmounted all difficulties, constructed a large carbolic acid plant, and is now turning out 2,500 pounds of the acid daily.

The production of benzol in this country for all purposes immediately prior to the European conflagration was 3,000,000 gallons, but this did not represent anything like the quantity actually consumed in the various industries, and an investigation was started which showed, as indicated above, that large quantities of this base were available if they could only be recovered and developed. Some of the large steel works are now producing benzol and the production has increased in proportion to about 15,000,000 gallons. It is true that the bulk of this supply is converted to use in the manufacture of explosives for war purposes; indeed, the present supply is not sufficient and prices are almost too high for manufacturers to use it for the manufacture of ordinary products not connected with munitions of war. But, as Mr. Stone points out in his address to the New York Section of the American Chemical Society, the fact remains that the production of benzol in this country has increased over five times, and this production is here to stay, and at normal prices will be used largely for the manufacture of other products which will develop with it.

It was at this point that he made the statement regarding the possible substitution of benzol for gasoline as a motor fuel, which has attracted much attention.

There is no novelty about the use of benzol as motive power for automobiles in place of gasoline. It is being largely used in Europe for this purpose, and the only reason it has not been used here has been the limited production and the high price, about double the cost of gasoline. Mr. Stone believes that, with the present increased production and consequent reduction of cost, benzol will eventually be manufactured and sold at a profit at the proportionate price of gasoline. However, automobilists need not look for supplies of benzol to replace gasoline until the present war is over, as the demand for war purposes is too great to permit of its utilization as mere fuel for motor cars.

It is not likely that benzol will ever sink so low in price as gasoline, and by "proportionate price" Mr. Stone referred to its greater motive power. Experiments have demonstrated that benzol has a motive power twenty-five per cent higher than gasoline; consequently it would have twenty-five per cent advantage at the same price. In view of the fact that the use of gasoline for automobile purposes is so large that the oil companies find difficulty in supplying it, the entrance of a new product like benzol as a substitute for gasoline may be one of the rather important, though crude, effects of the present war.

But Mr. Stone by no means confines his remarks to a consideration of the coal tar products, for he covers the field of commercial chemicals generally, tracing the effects of the interruption of communication with the European countries from which our main supplies were derived, upon our home industries, and what is being done here to remedy the present shortage. He also has something to say about the future protection and preservation of our new industries.

Mr. Stone's complete address will be found in next week's issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

Electricity

Electricity Is Used to Dry Motion Picture Films in a developing and printing laboratory in Yonkers, N. Y., during rainy and damp weather. The wet film, fresh from the developing and washing tanks, is placed on large wooden drums which revolve slowly before electric heaters of 3-kw. capacity.

A Pocket Sized Blasting Machine has been introduced which, while capable of supplying current for the firing of from three to five blasting caps by a sharp twist to its handle, measures but 4½ by 3⅝ by 2⅛ inches and weighs 4½ pounds. The handle can be removed when desired, thus rendering the machine foolproof.

Record Life of Tungsten Lamp.—What is perhaps a record life for tungsten lamps is presented in the case of a lamp installed five years ago in a garage at Sonoma, Cal., and which has been burning almost continuously every night during the expired time. It is estimated that the lamp has burned during some 20,000 hours. At the prevailing rate of 10 cents per kw. hour, this would represent a current consumption amounting to $200. The filament was still intact when the lamp was recently taken down from its fixture.

Electric Power Furnished to Yachts While at Dock.—One of the novel applications of central station power is presented at the Tebo Yacht Basin Company's docks in Brooklyn, N. Y. In order that it will not be necessary for docked yachts to operate their electric lighting plants yet not be deprived of the use of electric lighting systems, the company supplies electric current to the vessels from the mains of the Edison Electric Illuminating Company. The total power consumed is measured by a meter installed in the office of the company, while individual meters measure the power consumed by each yacht.

The Slotting of Commutators of Electric Motors has been extensively applied in electric-railway work and is now gaining favor in other motors where commutating conditions are severe, as in elevator motors, crane motors and, to a lesser degree, to direct-current generators and rotary converters in which the peripheral speed is sufficiently high to prevent dirt from locating in the grooves between the commutator bars. The lowering of the mica insulation between commutator bars to some distance below the surface of the commutator is claimed to result in the elimination of direct-current motor troubles to a great extent. Obviously, precautions must be taken to keep the slots free from dust, oil and carbon and copper dust.

Increasing Use of Flaming Arc for Paint and Dye Testing.—At a recent meeting of the American Electrochemical Society a paper was presented on the use of the flaming arc for paint and dye testing. The suggestion was made that with a consumption of 25 amperes, the lamp be used at two feet away from the samples being tested. The author declared that after having made several hundred tests between sunlight and the white, flaming arc lamp, he had found the latter far superior. The flaming arc lamp was also found more satisfactory than the nitrogen filled lamp and other illuminants. Not only does the flaming arc give more uniform conditions of test, but it is more rapid and tests can be made in 10 hours which require two weeks by sunlight.

Arc Principle Applied to Soldering.—An electric soldering iron of radically new design has recently made its appearance on the market. Instead of employing the usual form of electric heating unit to heat the soldering iron, two carbon or carborundum high resistance points are mounted a fraction of an inch apart and so placed that the article to be soldered is bridged across them. The two points become incandescent and apply their heat at the spot desired. Whereas it requires from 8 to 20 minutes to heat the usual form of electric iron, the new soldering device is instantly ready for use. It consumes current only during actual use and eliminates all losses of heat through conduction and radiation incidental to the usual irons in which a large mass of metal must be heated.

Heat Treatment of Steel by Electricity.—An electric furnace for the heat treatment of steel used in automobile construction has just been introduced. Its method of producing uniform, dependable heat that is so urgently sought by automobile manufacturers is quite novel in electric furnace practice, although its principle is comparable to that of the well-known Nernst lamp. Both the floor and the dome-like covers of this furnace are of a refractory material which is practically non-conducting at ordinary temperatures. To start the furnace, a current is passed through a bed of coke laid on its floor. Upon being sufficiently heated the floor becomes a conductor and in turn heats the walls and top, rendering them conducting, until finally the entire furnace becomes incandescent. It is stated by those who have tried the furnace that its use in the heat treatment of automobile parts promises to be extensive in the future.

Science

The Ice in Kara Sea.—In his recent book "Through Siberia, the Land of the Future," Dr. Nansen devotes an appendix to a discussion of ice conditions in Kara Sea, the point upon which hinges the successful navigation of the sea route from Europe to Siberia. A history of the attempts to navigate this sea, and of the conditions found, is given for each year for which any information exists from 1556 down to the present time. This survey shows, says the author, "how remarkably rare it is in more recent times for ships to fail in getting through this sea, when serious attempts have been made." In the past forty years there have been only four—*viz.*, 1882, 1902, 1903 and 1912—in which the ice prevented all ships from reaching their destinations. Dr. Nansen has for some time urged that a regular survey of the ice conditions in this sea be maintained every season by the use of aeroplanes and wireless stations, and if this plan should be adopted it is probable that even in the most unfavorable years a passage through the ice could be found.

Mathematical Printing.—The London Mathematical Society has issued a circular calling attention to the difficulties experienced by printers in setting up various forms of mathematical notation, and urging authors to help reduce such difficulties to a minimum. One of the commonest difficulties is caused by the use of a horizontal bar above a group of symbols, where brackets would answer the same purpose and cause the printer no trouble. Such a bar has to be cut to the proper length, placed in a separate line, and pieced out with "leads," also cut to proper sizes, to prevent it from slipping. When the page is printed these leads cause an irregular space between lines. (Examples will be found in almost any mathematical textbook.) For a similar reason the L-shaped factorial symbol is troublesome to set up, and should be superseded by the exclamation mark. When fractions occur in the body of continuous matter, the horizontal bar between the numerator and the denominator causes difficulties. This can often be replaced by the "solidus," or slanting line, as seen in the following expression: $(ax+b)/(cx+d)$. When an equation or other group of symbols occurs in a separate line, the objection to the horizontal bars of fractions is not serious.

Important Contributions to Phenology.—Phenological observations consist of records of the periodic phenomena of plants and animals, particularly the former, and are a valuable index of weather and climate. If, in any region, the flowering or leafing of plants is observed to be behind the usual dates for such phenomena, we say that the season is "late," and correctly assume that meteorological conditions have been abnormal. Again, a comparison of the average dates of these phenomena in different parts of a country gives information as to the distribution of climate, which supplements in a useful manner that shown by ordinary climatic statistics and charts. The Weather Bureau has just published as a supplement to the *Monthly Weather Review* two valuable contributions to the phenology of the United States; *viz.*, "A Calendar of the Leafing, Flowering, and Seeding of the Common Trees of the Eastern United States," by G. N. Lamb, and a remarkable phenological record kept by T. Mikesell from 1883 to 1912 at Wauseon, Ohio. Every dweller in the eastern states who takes an interest in "nature study," should have Mr. Lamb's ingenious charts at his disposal. Mr. Mikesell's record, though of less general interest, is a monument to the observer's industry in maintaining records of all the common wild and cultivated plants in his vicinity for a period of thirty years.

The Most Widely Used Drugs.—It is practically impossible for the average physician to familiarize himself with the four or five thousand drugs and drug preparations in everyday use in this country. One of the difficult problems of the medical curriculum has been to give the student a sufficient superficial acquaintance with a large number of such medicaments to enable him to answer questions likely to be asked about them by the state medical examining boards. The number of such substances also militates against their intelligent use by the practicing physician and their correct preparation and dispensing by pharmacists. In order to meet this situation, a committee of the American Medical Association some time ago drew up a list of about 450 drugs and preparations, selected on account of their wide use, with a view to concentrating the attention of everybody concerned upon these important medicines. The advice of teachers in medical schools, medical examining and licensing boards, and the profession generally was sought in making up this list, which is so liberal in character as to include a number of articles not recognized by the United States Pharmacopeia. According to the *Public Health Reports*, a revision of this list has just been undertaken, and criticism of the list as now constituted is taught by the American Medical Association.

Automobile Notes

Baltimore Has Simple Headlight Law.—Dodging the puzzling problem of what is a "blinding headlight" in the sense of the state laws, the Baltimore City Board has issued a peremptory ruling to the effect that "all headlights on automobiles must have their front glasses ground or otherwise obscured so that the filament of the electric bulb is not visible from the front." This rule goes into effect on November 15.

The Battery Rental System and Electrics.—The results of the systems of renting storage batteries is awaited with considerable interest. One result of the system is the sale of vehicles without batteries, at a considerable reduction in price, by one manufacturer, which permits the purchaser to use any one of a number of different batteries, as he may prefer. With the rented battery the vehicle owner is guaranteed in regard to the mileage he may expect from his batteries, and when he lays the machine up he gets an allowance for the time it is out of use.

Automobiles Cut Bank Deposits.—Actual proof that the extensive use of automobiles is cutting heavily into the bank deposits in the Western states, was furnished last month at the meeting of the Wisconsin Bankers' Association. Figures produced at the meeting showed that $70,000,000 in cash had been withdrawn from the banks of that state for automobile expenses alone in the shape of straight withdrawal of deposits, money borrowed or notes purchased. As a result, said the bankers, money is actually scarce in the state.

Acetylene Cooking Stove.—Motorists on tour, whose car is fitted with an acetylene gas tank for lighting, may now enjoy a well-cooked meal, while camping, without having to carry an alcohol stove or make a wood fire. They simply take the new "hot plate" supplied by the same company that furnishes the gas tanks, attach the rubber tube to the tank, and—presto! a first-class gas stove is ready. As acetylene gas gives an intensely hot flame, the holes from which the gas issues are very small and an hour's cooking requires only 3½ feet of gas, at an average cost of about 10 cents an hour.

Piston Ring Troubles—With the growing use of soft steel piston rings in internal combustion engines, a new difficulty has appeared which threatens to ruin a good many otherwise perfectly satisfactory motors. It is this, the mistake made in fitting the rings on the pistons. Too many owners do not know that a piston ring, although it can be "spread" so as to slip over the top of the piston into the groove, should never be treated in that manner. If a piston ring is spread until it slips over the piston, its shape is permanently distorted and its sharp edge will scrape the interior of the cylinder until it ruins the whole cylinder. The proper way to replace a piston ring which has a split in it—and nearly all have—is to insert the end of the ring in the groove, and then "thread" the ring into the groove until it fits. In this manner, the ring is subjected to only a small distortion and assumes its normal shape as soon as it is in the groove.

Aluminum Pistons and Oxygen.—The increasing use of pistons of aluminum alloys in automobile engines has brought up a new problem which engineers heretofore have disregarded. Arguments advanced by a thoughtful motorist recently have dropped in the engineering body what almost amounts to a bomb. The seemingly innocent question, which (has already caused a good deal of heated discussion and) is still far from being answered, was: "Is it safe to use an oxygen decarbonizing method when the pistons are of aluminum alloy?" Not a single engineer has yet dared answer this in the affirmative. Aluminum does oxidize much quicker than iron in an oxygen atmosphere; and tests will have to be made to show just how much more rapid such oxidation is under the great heat of the oxygen-acetylene flame. If these tests prove what engineers fear, then another method of decarbonization is needed—or aluminum alloy pistons will have to be abandoned.

Tire Chains and Skids.—The majority of automobile owners fit chains to the rear wheels only, and appear to consider this ample insurance against accidents from skidding, but this practice is a doubtful economy, for, although the rear wheels, thus armed, may hold the road fairly well, the really bad accidents too often result from the inability of the driver to control the course of his machine. Any old bicycle rider knows that he can retain the control of his machine and maintain his balance when the rear wheel skids badly as long as the front wheel holds its grip on the road, but that he becomes helpless whenever the front wheel slides. The same conditions are true in the case of the automobile, but in an exaggerated degree, for its weight and the average speed both tend to make the grip of the front wheels on the road precarious, and a skidding front wheel is not much different from a broken steering gear in the possibilities of disaster. Recognizing these facts, it is apparent that chains are fully as necessary on the front wheels as on the rear.

Recent Advances in Wireless Measuring Instruments

An Instrument for Determining Logarithmic Decrement of Transmitters

By Herbert T. Wade

THE efficiency of wireless telegraph apparatus depends in large measure on the nature of the electromagnetic waves sent out from the transmitting station, and the laws of the United States which govern the commercial, amateur and marine practice of radio telegraphy specify in particular that the waves must be of such form that the logarithmic decrement for a complete oscillation as employed with land or sea stations shall not exceed two tenths, except when sending distress signals or messages relating thereto. The logarithmic decrement is a mathematical expression for the measuring of the decay of a train of waves, being a constant ratio for any oscillation to the next succeeding one, and this should be made as small as possible so that the series may closely approach the conditions of a persistent oscillation of a single frequency. This is an ideal condition, permitting of the use of a much more selective receiving apparatus, thus enabling sharper tuning with a consequent minimizing of interference caused by the waves from other stations.

In the testing and adjusting of a wireless installation there are many occasions when it is desirable to measure the logarithmic decrement and the length of the waves emitted. When this work is done by a Government inspector or under conditions of ordinary test, it is desirable to have a direct-reading instrument and one that can be operated with a maximum of convenience in such situations as on shipboard. Accordingly, an ingenious and efficient instrument for this purpose has been devised by Mr. Frederick A. Kolster physicist of the United States Bureau of Standards at Washington, D. C., which has received the well merited honor of a silver medal from the Panama-Pacific Exposition. This instrument is now issued as part of the regular equipment to the radio inspectors of the Bureau of Navigation, United States Department of Commerce, and is also extensively used by the United States army and navy.

In the Kolster instrument, which is known as a decremeter, there is an ingenious combination of a hot-wire ammeter, an adjustable condenser, various inductances, and a series of indicating devices which enables the logarithmic decrement to be read directly, as well as the wavelength of the signals sent out by the transmitting station, or, when connected with a receiving apparatus, the waves received from a distant station.

The logarithmic decrement from the mathematical discussion of the fundamental equation used in radio telegraphy can be written in terms of the constants of the circuit, or in other words, the logarithmic decrement $d = \pi RC\omega$; also $d = \frac{\pi R}{L\omega}$ where R represents the resistance, C the capacity, and $\omega = 2\pi$ times the frequency of oscillation. By another formula the sum of the logarithmic decrements in two circuits which are loosely coupled or able to act on each other inductively can be expressed in terms of a change in capacity and current. Now if the capacity can be adjusted in such a way as to be measured and the current indicated by some form of ammeter whose readings are proportional to the square of the current, then, by determining the logarithmic decrement of the circuit formed by the decremeter and its accompanying coils, the decrement of the aerial or transmitting circuit can be readily obtained. By changing the values of the capacity, thus altering the current or energy in the circuit, a series of points may be determined from which a resonance curve can be drawn to indicate the decrement involved in the special length of wave that is being sent out. What Mr. Kolster has done in his new instrument is to attach to a variable condenser of novel design a single, predetermined scale giving values of the logarithmic decrement corresponding to various percentage changes of capacity throughout the range of capacity of the condenser, as defined by a formula originally evolved by V. Bjerknes. He has ingeniously determined the proper shape for the movable plates or surface of the condenser in order to produce a variable capacity whose change in value is constant throughout the range of motion of the moving surface. In this condenser the stationary plates are semi-circular, but the movable surface is designed in accordance with a geometrical law deduced from the Bjerknes equation. The rotary condenser is constructed with the fixed capacity connected and parallel with it, so chosen as to give the desired ratio between the maximum and minimum capacity of the combined condensers, and to furnish a calibration curve by which a predetermined scale can be attached to the rotary condenser. The movement of the index of the rotary condenser is magnified by means of gearing connected to the condenser shaft, and the final graduations for the scale are evolved from the formula, duly computed and permanently marked.

In measuring the logarithmic decrement with the new instrument, the rotary condenser is first set at the position of complete resonance where the ammeter dial indicates a maximum of current in the circuit of the instrument itself, which is inductively coupled to the antenna circuit. This maximum deflection is reduced to one half its value by turning the knob which decreases or increases the capacity of the rotary condenser. Then the decrement scale, which may be rotated independently, is set at zero and clamped so that when the condenser is again varied it will rotate with it. Starting at the zero setting with the hot wire instrument reading one half the maximum deflection the condenser is varied continuously in one direction until the needle of the hot-wire instrument makes a complete maximum deflection and back again to one half deflection. The scale reading opposite the index mark O, is the value of $d_1 + d_2$; d_1 being the decrement of the circuit under test, and d_2 the known decrement of the instrument. The arrangement of the circuit of the instrument is shown in the accompanying diagram. *I* is a single coil which may be connected in the circuit under test, as for example the aerial circuit of a radio transmitter, and in practice is a single loop which is connected at the corner of the instrument. *L* is the inductance coil of the decremeter circuit and is so arranged that the mutual inductance between it and the coil *I* can be easily varied, but it is essential that the degree of coupling between the circuit under test and the decremeter circuit be small. C_v is the variable condenser to which the decremeter scale is attached through gears, and parallel with C_v is the small condenser C_1 which remains fixed in value after proper adjustment. *H* represents the hot-wire ammeter or indicating device the scale of which is so marked that the readings are proportional to the square of the current passing through it. A crystal detector *D* is provided, and the wave length of distant stations may be measured by using telephone receivers *T*. The buzzer circuit *RBE* containing various resistance coils may be connected to the instrument for purposes of calibration.

Inasmuch as the capacity of the variable condenser of the decremeter varies according to a definitely known law, it is possible to attach a wavelength scale which will indicate wavelengths directly, and this scale is arranged so that it can rotate about the shaft of the variable condenser independently, but remains stationary when the condenser is rotated. A pointer is attached to the shaft of the condenser and travels over the scale as the condenser rotates. Several coils are supplied with the instrument and the position of the wavelength scale is adjusted to correspond with the particular coil employed. By various adjustments of the scales the pointer on the shaft will point to the wavelength when resonance is obtained as indicated by the maximum reading of the hot-wire ammeter. The instrument may be used as a receiver with the detector and telephones, or as a transmitter using the buzzer, but in the latter instance the wavelength scale requires a correction supplied from a calibration curve for wavelength ranges below the 90 deg. position of the condenser. The instrument, which occupies the space of and is encased to resemble the ordinary dress suit case, has been found particularly practicable and useful both for its portability and its accuracy, and its use is an essential feature of the extensive wireless inspection of merchant vessels undertaken at various American ports by officers of the Bureau of Navigation.

In connection with the decremeter described above there has been developed by Mr. Kolster a combination receiving outfit which includes a decremeter, wavemeter and receiver, which will add materially to the convenience of the work of inspection, inasmuch as it can be installed in the offices of the Government inspectors for the purpose of measuring wavelengths of distant ships and shore stations, and thus save in many instances considerable time and trouble. It consists of a selective receiver which lends itself to great ease of operation and indicates directly the wavelength received. It also comprises a direct-reading wavemeter and decremeter for station use.

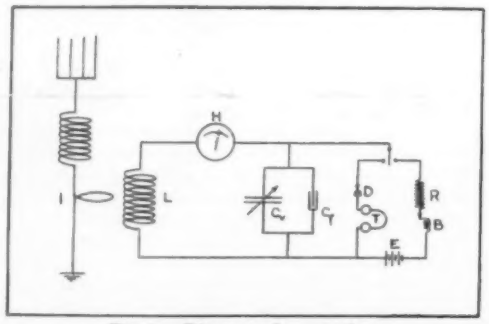


Fig. 1.—Diagram of connections

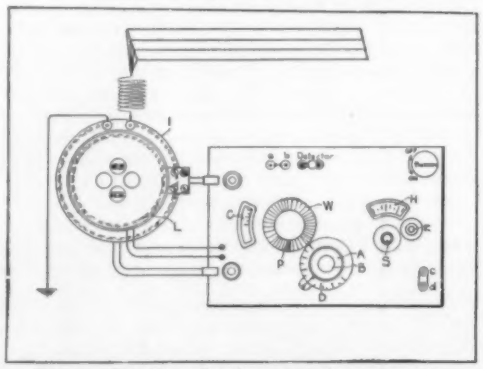
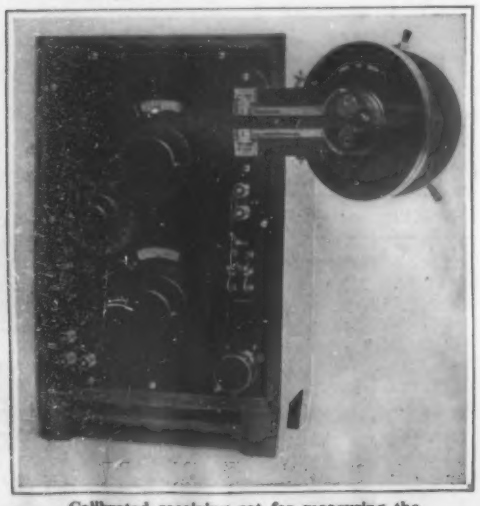
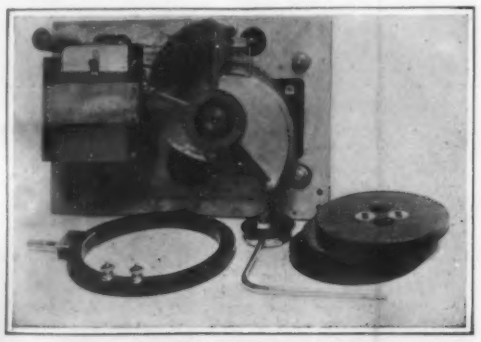


Fig. 2.—Top view showing general arrangement

W = Wavelength scale.
C = Condenser scale in degrees.
D = Decrement scale.
H = Scale of hot-wire instrument.
S = Short circuit release.
A = Knob operating variable condenser.
B = Clamping screw.
Z = Zero adjusting screw.
a b = Terminals of condensers.
c d = Terminals for series connection.



Calibrated receiving set for measuring the wavelength of incoming signals



The mechanism of the Kolster Decremeter and the coupling spools

A portable Kolster Decremeter of the type employed by radio inspectors

The 350-Mile Astor Cup Auto Race

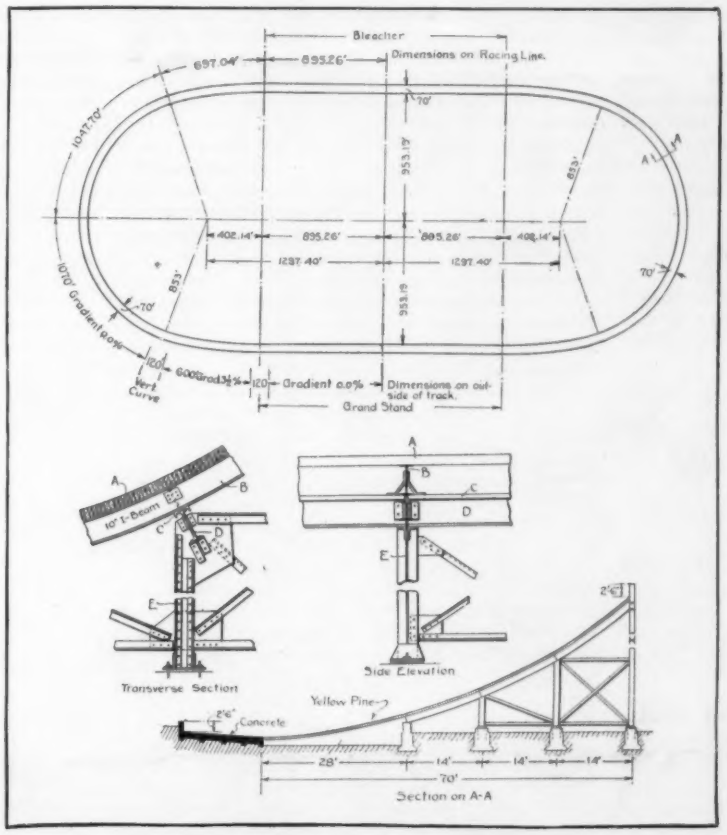
American Cars Win First and Second Place in Record Time

ALTHOUGH New York has been a little late in making special provision for those long-distance auto races which have become so popular in America, this city has now signalized her active entrance into the sport by constructing, at Sheepshead Bay, a race track which, in its design, construction and general equipment is equal, if not superior, to the best of the several auto speedways that have been built.

The opening of the race track was celebrated by the running of a 350-mile race for $50,000 and a cup, offered by Vincent Astor; and, except for the rather early break-down of several of the cars and the elimination thereby of many of the most noted drivers, the race was a brilliant success. The weather was perfect, the crowd numbered between 50,000 and 60,000, the race was the fastest of its length ever run, the winner making an average speed of 102.6 miles per hour, and, finally, the winning of the race by two American-made Stutz cars, each of which broke the existing records, was a notable demonstration of the fact that, even when put to the supreme test of a long-distance race, the American motor car is in the very forefront of industry, and in racing cars, for the present at least, holds the first place.

The new Motor Speedway is located on the level lands lying between Jamaica Bay and Sheepshead Bay, Brooklyn. It was designed to be, and probably is today, the fastest race track of its kind in the world. The track, which is 70 feet wide, consists of a surface of 2 x 4-inch timbers, laid on edge and supported either upon concrete or upon a system of steel ribs carried by steel posts with stiffening ties. The inside of the track is a 6-inch concrete pavement, which is 15 feet wide on the straightaway and opens out gradually to a width of 30 feet at the middle of the turns. This concrete pavement is provided for the use of such racing machines as, through disablement or for other reasons, have to draw out of the race. Opposite the grandstand is a long series of "pits," built of concrete and provided with all the conveniences for rapid attention to the cars when they stop for fuel, change of tires or such repairs as can be made during a race.

On the two 180-deg. turns, the outer edge of the 70-foot track is given a maximum superelevation above the inner edge of the track of 25 feet, 6 inches. The curve of the track on these turns, in a vertical plane, is a true parabola, the "steepness" of the curve gradually increasing from the inside to the outside, and the pitch being computed for speed for 40, 52½, 65, 77½ and a maximum of 96 miles per hour at the outer edge of the curve. It will be noted that this maximum was exceeded by the average speed of 102.6 miles of the winning car, and was considerably exceeded by the Peugeots, which, as long as they remained in the race, ran at speeds of from 105 to over 109 miles per hour. In the case of a car running on the outer edge of the curve at 96 miles per hour, the resultant of the centrifugal force, acting horizontally and the weight of the car acting vertically, would be normal to the track surface.



Constructional details of the speedway

The length of the track, measured on a line 3 feet from the inner edge, is as follows: there are two straightaway stretches of 1,790.5 feet and two turns of 3,489.5 feet length each. The center of each turn is a circular arc of 863-feet radius and 2,095.4 feet length, with spiral connections to the tangents, each of which is 697 feet long. The object of these spirals is to lead the car from the straightaway into the turn by curves of gradually decreasing radius, thereby avoiding any heavy side stresses and bringing the cars sweetly and without jar into the circular path.

The inner portion of the track is carried upon transverse concrete girders, and the outer portion of it upon a system of steel girders, longitudinals and posts. In the steel portions of this substructure, the flooring, which consists of 2 x 4-inch yellow pine, laid on edge, is secured to 10-inch transverse I-beams, rolled in the shop to the true parabolic curve. These I-beams are tied together longitudinally by I-beams, and, at the points of intersection, the load is transferred to vertical columns which rest upon substantial concrete footings. The supporting columns are spaced 14 feet apart transversely of the track and 20 feet apart longitudinally. The whole structure is built to carry a live load of 3,000 pounds motor cars on 5 x 10-foot wheel bases, the stresses being

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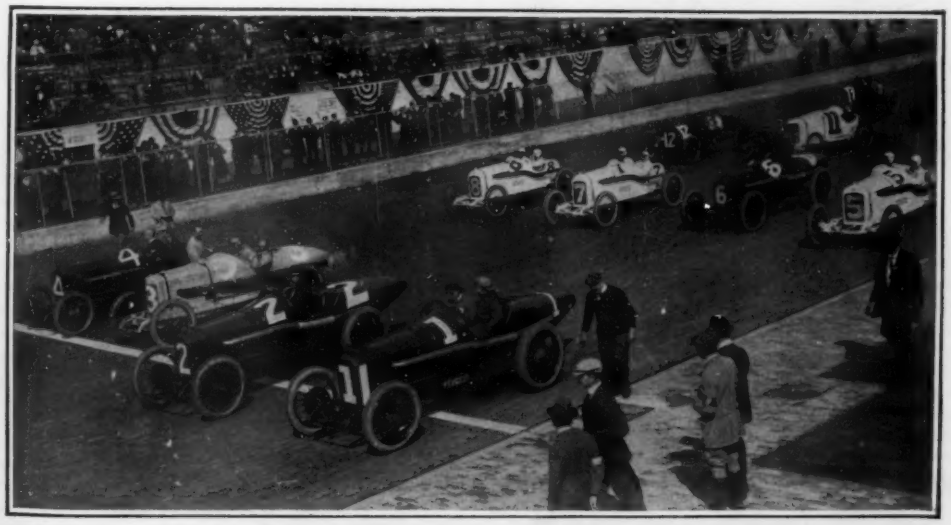
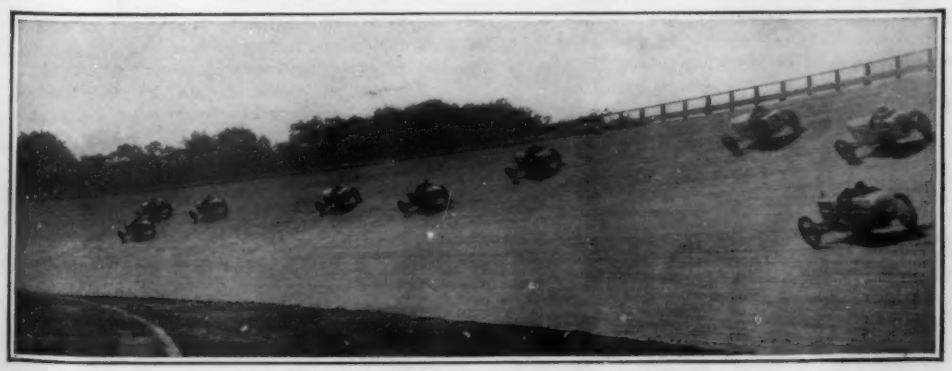


The cars lined up at the start of the 350-mile race

A stop at the repair pits



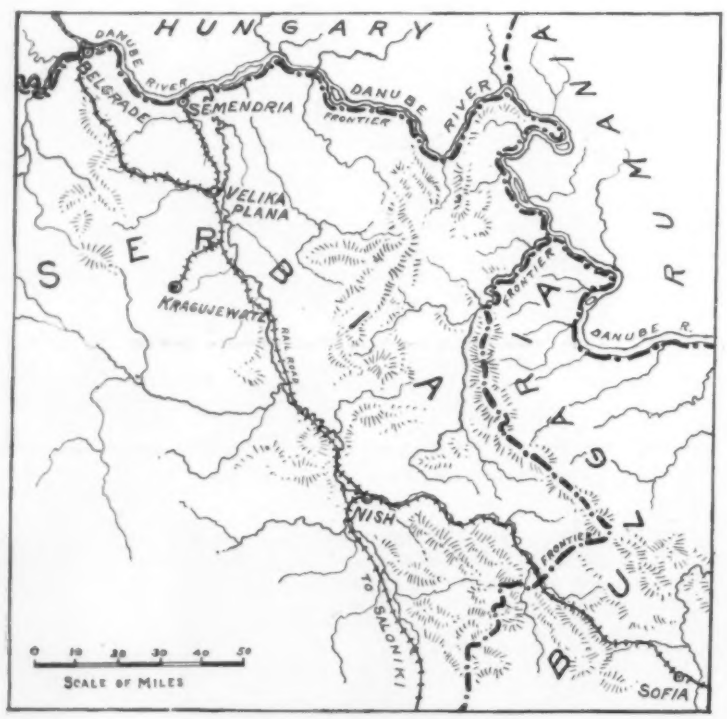
On the turn, which is banked for speeds of from 40 to 96 miles per hour

Anderson, winner of the race. Speed, 102.6 miles per hour

Strategic Moves of the War, October 14th, 1915

By Lieut. J. B. W. Gardiner, Formerly of the 11th Cavalry, U. S. A.

THE key to the riddle of the Balkans was found the day that the intentions of Bulgaria became manifest. At Bucharest, Sofia and Athens there had been waged for months a diplomatic battle the importance of which was hardly second to the military battles being fought in France, in Russia, in Austria, in Turkey. The objective was Constantinople. The wealth of Russia's wheat belt was locked up in the Black Sea and demanded an outlet. The urgent need of the Russians for ammunition, which only the west could supply, demanded an inlet. The passage of the Dardanelles was the sole solution of both problems. The French and English on the Gallipoli were pressing the Turks hard. Turkish ammunition was becoming scarce. A cry to Germany for help was the Turks' solution. The transport of assistance across Rumania was the simplest answer and involved the shortest route. But Rumania mobilized on her Austrian frontier and refused to allow it. Bulgaria was a second choice—objectionable because, in order to use the Bulgarian railways, it was necessary first to conquer Serbia at least to the point of controlling the road from Belgrade to Nish and from Nish to Sofia. This meant delay, but there was no alternative. The diplomatic battle was localized at Sofia, and Germany won. Bulgaria entered the war on the Teuton side and the envoys of the Entente were given their passports. The political considerations which led to this decision, Bulgaria's demands and the reasons behind them, have been so thoroughly discussed and debated in the general press that no repetition is necessary. The Allies had nothing to offer except territory that belonged to some one else, who was none too willing to cede it, and as the attitude of all the Balkan states is entirely mercenary, Bulgaria decided against them. The race is now on for Constantinople—and none can say which will arrive first, German reinforcements and supplies or the battle fleets of the Entente. Bulgaria's decision will exercise a tremendous effect on both Greece and Rumania, and it seems inevitable that they both will be drawn in on the side of the Entente in spite of the relationship existing between the German Kaiser and the Greek King. The fact that the Allies are using Saloniki, a Greek port, as a base from which to send assistance to Serbia and to war against Bulgaria and the Teutons makes it seem impossible for Greece to continue to be neutral. Serbia in this is simply exercising the leasehold rights which she acquired by treaty at the end of the Second Balkan War. But it creates a situation unique in international relations, and one which Bulgaria cannot continue to regard with friendly eyes, no matter how it may be regarded by the Teuton allies. In fact, a protest against the continuance of the use of Saloniki has already been filed with Athens. In regard to Rumania, the operations from Orsava, which months ago was made a German point of concentration for the operations in Serbia, bring the war close to the Budapest - Bucharest - Sofia - Constantinople railroad—which runs partly on Rumanian soil and makes the violation of Rumanian neutrality a very probable occurrence. Bad blood already exists between Rumania and the Teutons by reason of Rumania's refusal to permit passage over her territory of supplies destined for the Turks. These considerations, as well as blood ties, will make it almost impossible to stem the conflagration before Athens and Bucharest are involved.



The field of operations in Serbia

At present public interest is found not so much in the fields of conjecture as in the immediate military operations along the Danube and the effect on the eastern military situation of Bulgaria's move.

The military operations must be discussed solely from a railroad standpoint. Germany's sole object being to reach Constantinople with supplies, which object demands control of the Serbian railroads from the Danube to Nish, no move will be made, naturally, which is not ultimately designed to effect railroad control, no matter what the immediate objective may be. Therefore, a study of the railroad situation is necessary to understand the basic idea behind the German operations. The most important road to be considered is the Budapest-Belgrade-Nish-Sofia road, which continues from Sofia to Constantinople—the so-called Oriental road, the control of which not only in time of war, but in peace times as well, is a pet German ambition, as it is the only direct road from Berlin to the Orient. It is against this road that Mackensen has begun his Serbian operations. This road has really two termini on the Serbian-Hungarian frontier, one at Belgrade and the other at Semendria, 25 miles to the east. The roads from these two points, running south, unite at Velika Plana, from which point the line continues to Nish, and thence to Sofia and Constantinople. From Belgrade to Velika Plana is about 50 miles, and from Semendria to the same point about 25 miles. It is against this triangle that Mackensen's efforts are being exerted. Concentrations were effected along the Save river at a point east of Belgrade, opposite Belgrade, which is at the confluence of the Save and the Danube, and opposite Semendria on the Danube. Columns from each of these three points advanced simultaneously, the rivers were crossed, Belgrade and Semendria taken. It would appear that the German plan is to shove forward these three columns, the two to the east to take the railroads, that to the west to protect the Belgrade-Nish road from an attack from the west as the centre column moves forward. The eastern column, having but half the distance to go that has the center column, would, naturally, be expected to reach the junction at Velika Plana first, and, by seizing the junction, cut the railroad behind the Serbians and compel their retreat westward, thus freeing completely the Belgrade branch and permitting a juncture of the two German columns. The triangle would then be under German control and the way to Nish open. At the same time the Bulgarians have moved against Nish from the west along the Sofia railroad, with the idea of reaching the Nish junction and thereby stop its use by the French and British, who are sending men and guns through Nish from Saloniki to the Serbian front. Thus the control of the only through railroad system from the Serbian-Hungarian frontier to Constantinople would fall into Teuton hands. This plan, however, will take a long time to consummate and will be beset with difficulties. The Teutons cannot move from Belgrade down the Belgrade-Nish road without guarding this road in rear of their advance. The Serbians are in considerable force in the mountain districts to the west of the railroad, and should they by a sudden raid succeed in cutting the line in rear of the German advance, a retreat would be inevitable, as this is the only supply line on which the Germans can depend for food and shell. The situation is entirely different from that which exists on either the western or the eastern battle fronts in that on the latter the German flanks rest on natural obstacles—a large body of water or a neutral border—and cannot be turned, while on the Serbian front, as so far developed, no such obstacles exist, so that the flanks will have to be protected by troops. This will consume a great number of men, who can only be supplied at the expense of the other fronts. Therefore, even though the advance of the Teutons across the river barriers has proceeded with but little effective resistance, any material advances beyond the border toward Velika Plana will be accomplished with considerably greater difficulty. It is not expected, however, that the principal Serbian effort to check the invaders will be made so far north. About 50 miles south of Belgrade a range of mountains runs northwest and southeast in which is situated the strong fortress of Kragujewatz. It was along this range that the Serbs made their stand against Austria, about a year ago, which resulted in the Austrians being first checked and finally driven completely out of Serbia. Moreover, now the French and British have strong contingents with the Serbian army, and are increasing their strength with reinforcements sent north from Saloniki. It is doubtful if Germany can spare enough men from other theatres to send an overwhelming force against Serbia. Their line in the west, as shown by the recent fighting in Artois and in Champagne, has already reached its elastic limit. On the Eastern front the Russian resistance has brought the advance to a temporary, if not a conclusive, halt. To draw farther from either would be to run grave risks; and yet it is only by an overwhelming force that operations in Serbia can have quick results.

The Bulgarian attack from the east, with Nish as its objective, will be an exceedingly difficult task. The borderland at all points except in the extreme north is extremely mountainous, which fact will enable the Serbians to prevent any serious advance of the Bulgarians, and with many less troops than the latter will use. On the whole, then, it is entirely possible, particularly after the Kragujewatz has been reached, that the operations will end up in trench warfare such as has characterized the western situation since the battle of the Marne.

It is entirely possible to conceive how Bulgaria's entrance into the war could change its entire aspect in the east. If Rumania and Greece persisted in their neutrality, and the Teutons, with Bulgaria's assistance, should be able to make short shrift of Serbia, Turkey's relief would be in sight and the allied operations condemned to failure. But there are many contingencies. They would all be serious factors in the problem, but are unlikely to happen. Much will depend on the operations of the next few weeks.

Lime Salts for Soldiers

THE remarkable results obtained by the German physiologists, Emmerich and Loew, in their elaborate and extensive experiments with calcium salts as a factor in the diet of both men and animals have aroused much attention in the past two or three years. The favorable results derived from the use of definite doses of lime salts are ascribed to the fact that calcium is an essential element, if not indeed the most important element which enters into the structure of the cell-nucleus of both animals and plants. This is why such marked debility is formed where this element is insufficiently provided. Dr. Loew has recently been continuing his studies of the subject with reference to the use of calcium compounds in the diet of soldiers, whether wounded or well.

In an article contributed by him to the illustrated medical journal *Hyg* (Munich), he declares that lime is peculiarly valuable in the diet of soldiers in the field, since its presence in the cell-nucleus in sufficient amount increases the organism's power of resistance to the chills and colds that are so often the starting point of serious maladies.

He maintains that lime salts in proper form and quantity work actual miracles. Among the wounded not only were injuries to the bone healed far more rapidly when the diet included a daily addition of 2 to 3 grammes of crystallized calcium chloride ($CaCl_2$) or 3 to 4 grammes of lactate of lime, but such addition usually hastened recovery in cases of other wounds not affecting the bones.

He recommends that at least "calcium bread," which is already much used in Germany, especially in Bavaria or South Germany, should be substituted for ordinary bread in the rations of soldiers engaged in active service.

The manufacture of this bread can be much simplified, it is stated, by the use of the so-called calcifarin-flour. This is a compound of calcium chloride with flour, a sort of double compound which does not become damp when exposed to the air. In making the bread it is only necessary to mix 5 per cent of the "calcifarin" with the flour.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Antisepsis or Asepsis?

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 28th, 1915, is an article headed "Military Surgery." It contains the following: "Surgeons are discussing which should be the method of choice in operating on the wounded in battle. Should it be Antisepsis or Asepsis?"

In surgery the term "asepsis" signifies a desired condition of wounds, and has not the remotest connection with the methods used to secure that desired but never attained condition of wounds. In other words the term "asepsis" has no connection with methods of any description. The term "asepsis" is applied to results. The result of a method is not the method.

Lister strove to secure an aseptic condition of wounds by the use of antiseptics. He never completely succeeded.

Modern surgeons strive to secure an aseptic condition of wounds by the use of antiseptics. They never completely succeed.

The objects and means used are identical. That is to secure an aseptic condition of wounds by the use of antiseptics.

The phrase aseptic surgery was introduced by those who desired to appropriate to themselves credit due solely and only to Lister. The trouble such people will take to gain their ends is certainly amusing. Had they claimed that they could use Lister's methods better than Lister could use them, there might have been some reason for the claim, but to claim that they had devised a new system of surgery merely because they use the same means for the same purposes in slightly different ways is absurd. No two surgeons in existence use antiseptics in exactly the same way, but all use antiseptics. There are no aseptics nor aseptic methods to employ.

The ridiculousness of the situation appears when we consider that these credit appropriators were unable to find a name for their imaginary new system of surgery which was in the remotest way connected with their methods and were forced to adopt a name, namely asepsis, which related solely and only to their desired but never attained object, namely aseptic wounds.

It is impossible to secure even an approximately aseptic condition of wounds without the use of antiseptics, and hence a surgery which has for its object an aseptic condition of wounds can never be other than an antiseptic surgery.

C. C. GRANT, M.D.

Red Deer, Alta., Canada.

Cultivation of Pineapples

To the Editor of the SCIENTIFIC AMERICAN:

I shall be very obliged to you if you can inform me of anyone interested in the cultivation of pineapples.

I shall be very happy to communicate with these gentlemen, and as there is an abundant supply of the Giant Kew variety here, I will be pleased to undertake the supply of suitable suckers at a moderate figure and all information free.

The plant grows easily and with very little attention when the mean annual temperature is not below 60 deg. Fahr. and with an annual rainfall of over 70 inches; and although they thrive best on a good loamy soil, moderate sized fruits weighing between 6 to 10 pounds each can be expected from each plant within a year from planting from any ordinary soil.

Recently there had been a fruit grown locally turning the scales at 54½ pounds, and fruits from 25 to 30 pounds each are not very rare.

If a fruit canning factory is within easy reach, the planting of these fruits ought to prove a very remunerative occupation, and the fruit itself besides being deliciously flavored, has valuable medicinal qualities and a specific for diphtheria.

The leaves too yield a very superior silky fibre, and are nearly thornless.

W. L. VAN DER SLOTT.

Department of Public Works & Surveys,
Kuching, Sarawak.

The Militia Problem

To the Editor of the SCIENTIFIC AMERICAN:

Will you allow a suggestion from a member of the National Guard of Colorado on a means of defense for our country.

In the National Guard of all the country, I do believe one per cent will be found to be union men. That is the point I want to bring out. In helping to organize a company in this state recently, I found again and again union men who had the wish to join a citizen army, men who were genuinely concerned for the defense of the nation, but were kept from joining the Guard for the reason, as one of them expressed it, "we don't know when we would be called upon to fight ourselves."

If the National Guard was exempted from taking sides (it practically amounts to that) in labor disputes, and were not required to preserve order in strike districts, the Guard could be increased five fold, if not ten fold, in a year. The regular army have proved themselves to be better able to patrol and keep order in strike districts than militia. The striker always has had more respect for the regular army; he knows that the regular army soldier is only working at his trade, whereas it seems to him a guardsman leaves his business and dons a uniform for the express purpose of defeating his cause.

This not only affects union men, but their sympathizers as well. The National Guard interferes with no man's business; any one can belong who is in good health; with the strike feature eliminated, membership in that organization would interfere with no one's principles, and of all who will give this measure attention, the majority will agree with me that there should be some place for the union man in the much-talked-of Citizen Army.

PATRIOT.

Selbert, Colorado.

Safety of Lake and Coastwise Passenger Steamers

To the Editor of the SCIENTIFIC AMERICAN:

In my letter on the steamer "Eastland" published in the SCIENTIFIC AMERICAN of September 25th, I said that I would like to hear from the Inspection Department regarding the stability of some of our coastwise steamers. I think it is only just to that department to inform you that I received a long, interesting and courteous letter from Eugene E. O'Donnell, the Supervising Inspector of the Fifth District, dated August 11th. In this letter he assures me that all the coastwise vessels entering and leaving Boston are stable, even though they may appear otherwise to the ordinary person traveling on them. He gives many details confirming this view, which certainly is very comforting to people who have occasion to use these vessels. He says especially that, "There is no vessel in this district that is considered as tender or cranky." The inspector clearly believes that stability tests should be made, but says that the inspection service has no authority to require such tests. He hopes for better legislation on the subject and regrets that it required such a tragedy as the "Eastland" accident to secure adequate laws on the subject.

While I am glad to know these facts from such an authority I still think that the general subject of lofty upper-works on many of our sea-going ships is one which well may enlist the careful study of marine architects. The tendency of late years has been to build such lofty deck-houses that it certainly must require some sort of ballast to counterbalance them. Such boats may be safe *when properly loaded*, but it seems to me they should be so constructed and the height of deck-houses, if necessary, so limited, that they *never, by any possibility*, could have a *negative metacentric height* even when they have no freight in them. The loading of freight is a haphazard affair at best, and the safety of a passenger ship should not depend upon the way in which the cargo is stored. There might be a time when the stowage would not be attended to with sufficient care. If water ballast is *depended upon for stability*, that might be neglected as apparently it was in the case of the "Eastland." In short, why not design a ship so that she is stable because of her own design and construction and not because she is loaded down with water ballast, cement and gravel ballast or any kind of freight? To my mind a vessel with lower deck-houses *looks* much more "ship-shape" aside from the question of stability.

I wish you could get some sort of expression from a number of naval architects on this subject and let your readers have the benefit of them. I believe there are many who would be interested, *as travelers*, just as I am. I admit that when I see a ship built out of water like a New York skyscraper I do not like to ride on her, and if I have to do so, I observe her action in a sea-way very closely and not without some trepidation. Let the naval architects tell us how many stories high above the main deck it is safe to build steel structures on a modern sea-going steamer of stated size.

C. D. IRWIN.

50 Willard Road, Brookline, Mass.

Dr. Cook and Crocker Land

To the Editor of the SCIENTIFIC AMERICAN:

In an article, "Dr. Cook as an Object Lesson," published in the SCIENTIFIC AMERICAN of October 2nd, it is stated "that the recent Crocker Land Expedition appears to have helped demolish Cook's story by proving the non-existence of Crocker Land, which Peary only claimed to have sighted in the distance, but which Cook described in detail as having been seen by him at close range. In the book last mentioned, Mr. Balch lays great stress upon this description of Crocker Land, pointing out that a confirmation thereof by other explorers would fairly rehabilitate the doctor's reputation." Will you grant me sufficient space to point out to your readers the errors in this paragraph?

In 1906, Peary believed he sighted a land, which he called Crocker Land, and which he charted between about 82° 30′ N. to 83° 20′ N. and about 106° W. to 103° W. In 1909, Cook reported the discovery in 1908 of a land, which he called Bradley Land, extending from about 84° 20′ N. to 85° 11′ N. near the meridian of 102° W. Between the northern extremity of Peary's Crocker Land and the southern extremity of Cook's Bradley Land, therefore, there is a distance of about 60 geographical miles, approximately a trifle less than the distance between New York and New Haven. It is self evident therefore that Peary's Crocker Land and Cook's Bradley Land are not the same, and the nonexistence of Crocker Land does not invalidate in the least the possible existence of Bradley Land. And I have said before and would like to say again, it is the existence or nonexistence of Bradley Land, not Crocker Land, which eventually will settle the validity of Cook's claims.

We may hope for MacMillan's extended report before long. But unless he has been well north of 84° in about 102° W., he can give no definite information about Bradley Land. Explorers cannot report negatively for more than a few miles distance in the Polar Regions. The latest example of this is the discovery two years ago by Russian officers of Nicholas II Land. Its southern extremity lies close to Cape Chelyuskin. Baron Nordenskjold and Dr. Nansen, both careful and reliable observers, therefore, passed immediately by it when rounding Cape Chelyuskin, yet neither of them sighted it nor suspected its existence, although undoubtedly they had lookouts with spyglasses in the crow's nests.

EDWIN SWIFT BALCH.

Philadelphia, Pa.

Safety Sidings

To the Editor of the SCIENTIFIC AMERICAN:

Your article on "Safety Sidings" in the issue of August 28th, leads me to compare the one described with those used for many years on the Kicking Horse pass of the Canadian Pacific Railway. They were three in number and situated about a mile apart on the western gradient. This was extremely steep, and required two of the "mogul" locomotives to push and pull eight or nine loaded freight cars up the hill. In the last few years the length of this section has been doubled and the grade halved, by means of circular tunnels, and the "safety switches" consequently were eliminated. They were operated by hand by switchmen always on duty, and the switches were always set for the safety track. When a train approached to within, say, a one third mile of the switch, the engineman gave a whistle signal indicating that his train was under control, in which case only, the switchman gave him the main line. The safety-switch called No. 1 was built on correct principles, *i.e.*, it was tangent to the curve at that point. The other two were faulty, as is the one you illustrated, in that the train at excessive speed is forced to take a more or less short radius curve. Proof of this was established by a freight wreck at switch No. 2, or No. 3, about 12 years ago, when the engineman attempted to take the safety-switch. The curve at the switch was too great and the locomotive jumped the switch and continued in a direction tangent to the line at that point, piling up against an enormous boulder between the main line and the "safety-switch." Several enginemen on this division have assured me that in case of a runaway, they would call for the main line in preference to switches Nos. 2 and 3, thinking it safer, if the main line were left clear.

LOWELL C. FROST, M.D.

6404 Hollywood Boulevard, Los Angeles, Cal.

Chinese Burials

To the Editor of the SCIENTIFIC AMERICAN:

I read in your issue of September 4, an interesting article entitled "Concerning Leprosy," in which the writer states that "in China, if report be true, lepers are made to dig their own graves."

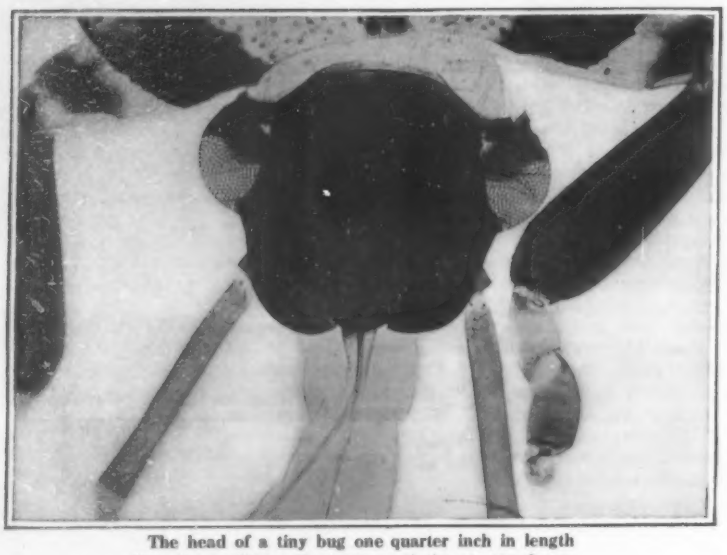
I have traveled several thousand miles in China, as an engineer, but have never seen a grave such as we have in the west. I have often pitched my tent among the mounds of Chinese burying grounds and on one occasion witnessed a native funeral.

So far as my observation extended graves are not dug for the dead or dying, in China, but when a burial takes place, the remains, enclosed in a coffin, are placed on the earth's surface and a mound built over them.

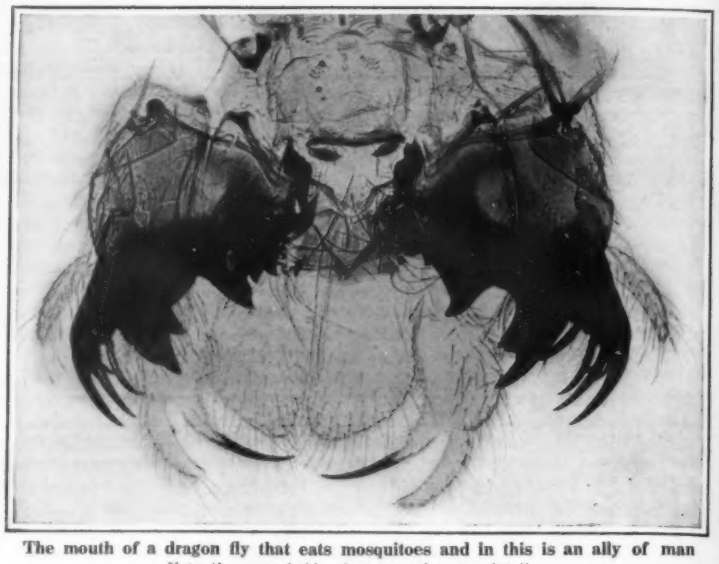
If, however, I am in error as to this being the universal custom in China, I would be glad to be corrected.

PAUL F. ROSSELL.

Wilmington, Delaware.



The head of a tiny bug one quarter inch in length
Note the position and structure of the compound eyes.



The mouth of a dragon fly that eats mosquitoes and in this is an ally of man
Note the remarkable clearness of every detail.

Portraying the Little Things of Nature

How to Arrange the Camera for Photomicrographs and Photomacrographs

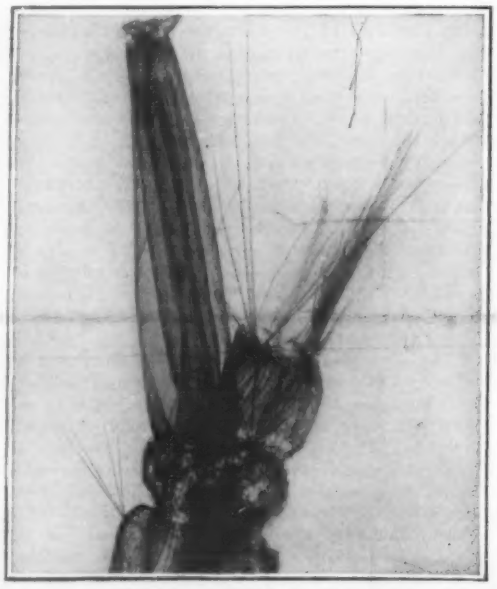
By Edward F. Bigelow

THE world is full of wonders "both great and small," but, strange to say, the great have attracted an undue proportion of attention, and have been more extensively portrayed. Many decades ago the veteran naturalist, Fabricius, said, "Natura, maxime miranda in minimis." (Nature is most to be admired in those works which are the least.) Every one who is familiar with the wonders "both great and small" I think would agree with this statement. The great things of nature have the chief attention very largely because they are more conspicuous and more easily depicted. Most camerists understand how to make reduced photographs and most photographs are reduced. It is the purpose of this article to explain how the little things of nature may be photographed so as to be easily seen and understood.

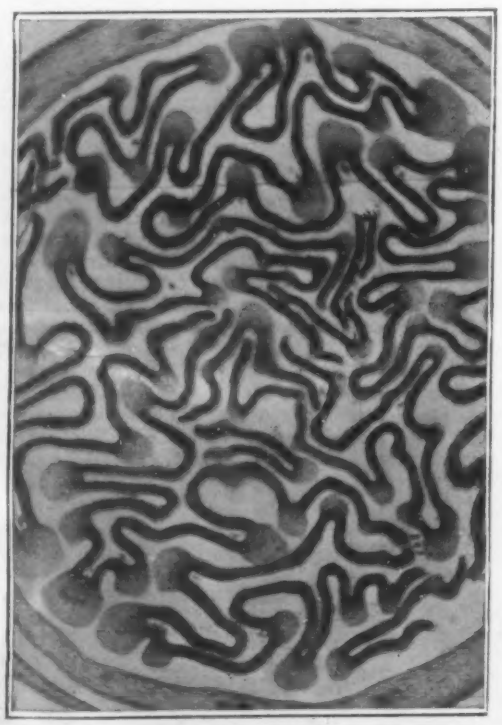
The three factors of photography are the object, the lens and the plate. When the object and the plate are equally distant from the lens the result is a photograph of the same size as the object. When the object is farther from the lens than is the plate the result is a "miniograph," if I may coin a term to fit the conditions. Miniographs have so completely monopolized the field as to require no special title to distinguish them from other photographs. If one photographs a mountain a mile away or a tree 40 rods distant, the result is a photograph much smaller than the object. The proportion between the size of the photograph and the size of the object varies as the distance from the plate to the lens varies in comparison with the distance of the lens from the object.

Photographs taken with the object instead of the plate at the focal point of the lens are for convenience of reference divided into two classes, photomicrographs and photomacrographs, the former being taken with microscrope objectives, with or without eye pieces, and the latter by camera lenses of short focus at a long distance from the plate. The ordinary method is to use a short focus lens with the plate from 3 to 4 feet distant. Some camerists claim that the magnification is obtained to better advantage by using a long focus lens with a still longer distance between lens and plate. David and Marian Fairchild in their "Book of Monsters" prefer a long focus lens with an astonishingly long camera. They use a camera box up to 24 feet in length. It is said that by this method there is less distortion and more depth. It is questionable, however, whether the advantages are proportionate to the increased difficulties. The amateur will usually prefer to use a camera of medium length, preferably one with bellows draw of ordinary length in the rear as well as in the front. Such a camera may be lengthened ad libitum by a cone or by a box extending from the lens board of the camera. The front end of such a cone or box holds the lens; the rear is attached directly to the camera in place of the lens board. High magnification may be obtained without the aid of microscopic objectives, by the use of either a short focus lens or of a long camera, or, even better, by a combination of the two.

If one wishes to make such photographs and has a long focus lens a dark box may be easily and cheaply added. If such a box is in the cellar, or other dark place, it may be built crudely and yet exclude the light. A box, a foot square, might be built as long as the cellar. In one end of such a box place the lens set in a board that should completely cover the end of the box. In front of the lens at the focal distance, should be some convenient device for holding the object, this to vary with the object to be photographed. Almost any kind of illumination will do, even lamplight will make a good photograph if given plenty of time, but acetylene is better, or if one is unwilling to take the trouble to generate acetylene, an ordinary arc light or, better still, a nitrogen-filled incandescent, may be used. At the other end the camera should be fastened centrally in the box, or it may perhaps be better to use only the plate holder and discard the camera.



The breathing tube of a larval mosquito
This is pushed up through the surface film of water. A film of oil on the water kills the mosquito by suffocation.



Cross section of tiny bud of sycamore maple showing curious maze of the leaf packing
The porous "knobs" are the cell structure of the leaf veins.

The accompanying photomicrographs were made with a camera of medium length, some with, some without, a cone extension on the front. If a microscope is used, the eyepiece end should be fastened in any light-tight way to the opening in the lens board. The manufacturers supply a convenient connecting medium at a moderate price, but even this is not necessary. Insert the microscope eyepiece in the opening of the lens board, and stop out all light by a piece of dark cloth wound around the microscope tube at the place of juncture.

It is better to take photomicrographs and photomacrographs at night, because the light is then more easily excluded from the sensitive parts of the apparatus. If the illumination is carefully managed, and the light turned on the object only, little attention need be given to the connections, since in a dark room there is no light to threaten disaster.

Small objects may be suspended against a piece of glass in front of the lens, and made to adhere by a touch of any adhesive material. The background is then placed so far away that a shadow shall not surround the object. This is a good method when reduced photographs are to be taken of small objects. If, for example, an apple is to be photographed without surrounding shadows, it should be flattened a little on one side and pinned to a piece of glass. It may seem strange to talk of pinning an object to glass, but every photographer should have pieces of glass of different dimensions, pierced by small holes to receive pins, that should vary in size and length from the ordinary form to the long hat pin. If the photographer has a pane of glass, say ten by twelve, he may make in the center two or three holes within a space of not more than 1½ inches in diameter. An apple or an ear of corn could readily be fastened to the glass by pins thrust through these holes from the back. The glass is then set upright, and the background put so far away that it will not be shaded by the object.

The best backgrounds are large sheets of cardboard obtainable from any paper warehouse, or printer. Select the colors that, after experiment, give the best effect with the plates used. It will be found that in most cases a light blue will give the most desirable white background effect, that a deep red is better than black for a dark background, while a gray background is conveniently obtained by a medium shade of yellow. These suggestions apply with especial force to photographs enlarged from the object, since the enlargement of the shadow is often unpleasant, and may obliterate the best part of the view. The backgrounds of the accompanying photographs are clear and sharp, because they were provided for as explained.

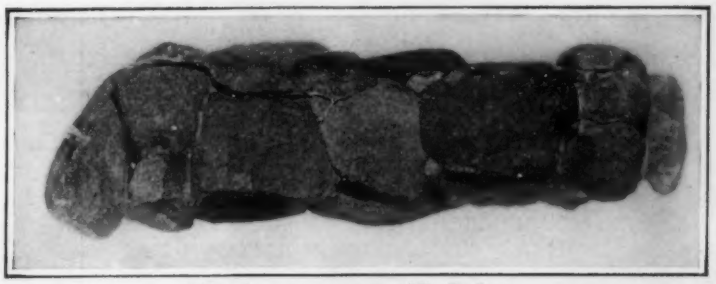
So far as the size of the photograph is related to the

size of the object, there is still to be mentioned a type of photograph not frequently made at present, but popular some thirty years ago. If, as has been explained, we photograph a mountain with a small camera the result is a picture small enough to be placed in a little souvenir book, but the picture of the mountain may be reduced to less than the size of a pinhead by continuing the process of reduction. This microphotograph is a photograph so small that it can be seen only when magnified by the microscope. This is now practically a lost art. Such productions are valued chiefly as curiosities, but a few are still found in almost every microscopical cabinet.

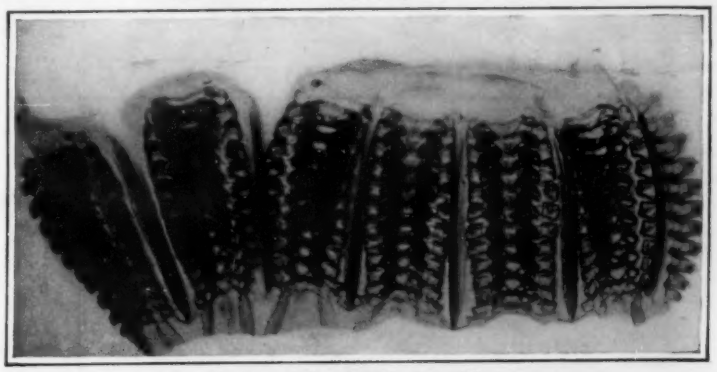
The writer strongly commends, especially at the present time, the making of enlarged photographs of the minute, microscopic marvels with which the world teems in the summer. Interest has waned in microscopy and increased in ornithology in the last 25 years, because of the skill acquired by the photographers of birds, and the neglect of photography by the microscopists. Twenty-five years ago microscopical societies existed even in every little village. Ornithologists were rare, with perhaps one to 10,000 inhabitants. The situation is now reversed. The popularity of bird study is largely due to the numerous photographs in many periodicals that show the attractive qualities of birds. The microscopist kept his science to himself; he did not make photomicrographs to show to others the things in which he found pleasure. The result is that the marvels of the world of small things are known to comparatively few. Photographs of every country in the world and the people thereof, pictures of animals, scenery, occupations, are plentiful everywhere, but the realm of little things is a country unknown to the general reader because it is an unportrayed country. It is a wonderland known to only a few persons. It is calling to camerists everywhere to put on lenses of shorter focus, or to add a Brobdingnagian length to the camera with which to record these marvelously little and marvelously perfect bits of nature's most delicate work.

The Current Supplement

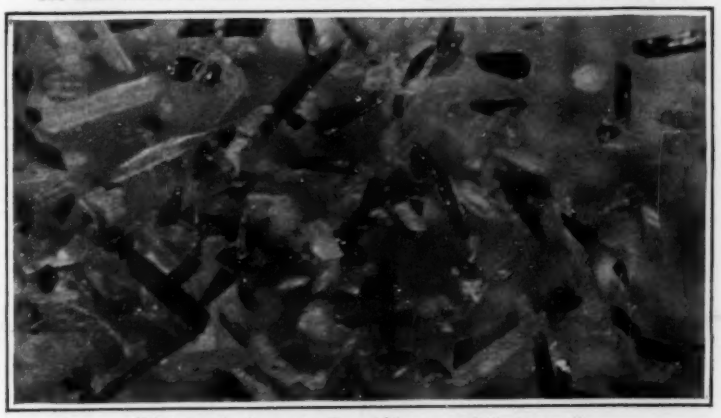
THE leading article in SCIENTIFIC AMERICAN SUPPLEMENT No. 2077, for October 23rd, 1915, tells of new evidence of the intensity of solar radiation outside the atmosphere. Success in the operations of both air ships and aeroplanes is largely dependent on weather conditions, as has been made evident in the various reported military operations in Europe. Some of the material facts are discussed in an article in this issue. A timely and valuable article is that by M. Eiffel giving the results of important experiments in aerodynamics. There is an interesting little account, accompanied by illustrations, describing the removal of a wreck by the use of dynamite. A great variety of different metals is used in warfare for armor, guns, shells and many other purposes. There is an interesting story on this subject that gives the kind of information that is now generally desired. Electricity is everywhere so generally employed that we are apt to overlook many of the most valuable of the newer applications. Nowhere can it save so much labor as on the farm, where it promises to eliminate the drudgery to an extent that will make farming a much more popular vocation than it has been. There is an extremely valuable, and readable, article on the subject, fully illustrated, in this issue. Pictures are daily becoming more essential for illustrating stories and descriptions of every kind, but it is not always possible to get photographs of a suitable quality for reproduction. The mere possession of a camera does not qualify the owner as a photographer, although the dealer tells him so. A careful reading of the article on making good photographs should be read by every camera owner, for none are too



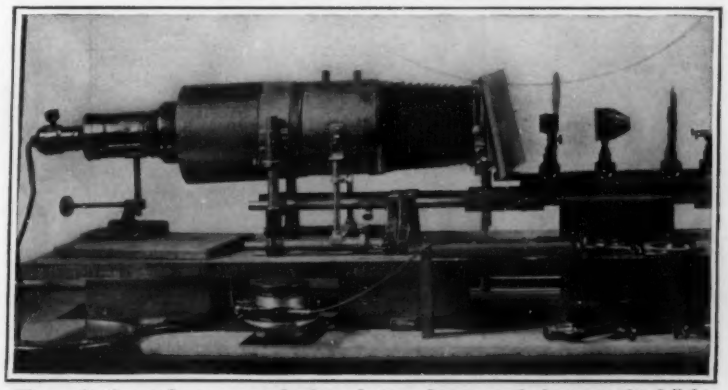
Marvelous masonry of caddis fly larva
The larva, about half an inch or a little more in length, cements these stones around itself. Note how wonderfully they are fitted.



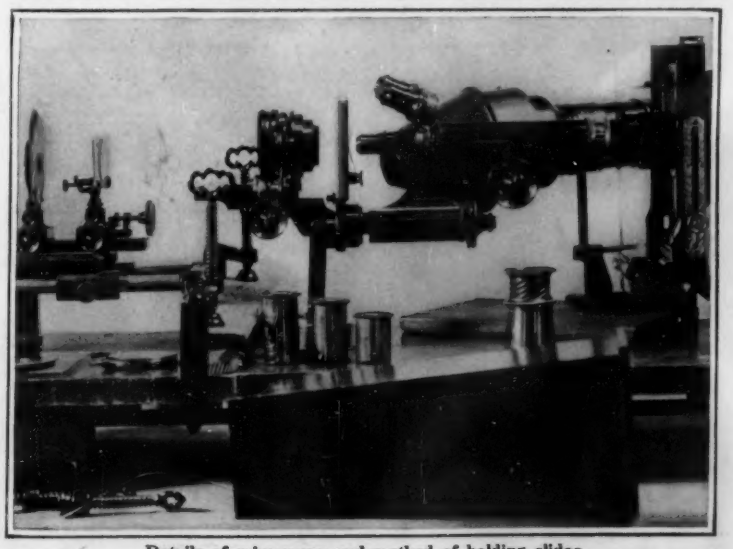
Section of the gizzard of a cricket
The house cricket has teeth on the interior of its gizzard with which to grind food.



What the barber cut off on "the second time over"
Note how diagonally some of the "tiny" bits were cut.



The projection end, as arranged when photographs are made by transmitted light



Details of microscope and method of holding slides
The tapering black box in the foreground is for photomacrographs, taken with long plate distance and short focus camera lenses.

experienced to learn. A short illustrated history of the rifle and its bullet will answer many questions now arising. Much has been published about the periscope, but it is not appreciated that there are many methods of constructing them. Here is an article with diagrams showing various internal arrangements and principles employed. Protection against fires is a subject that constantly appeals to everyone, and the article on the causes of conflagrations and methods by which they may be prevented will be found of general interest. Other articles deal with boiler corrosion and the prevention of scale; the use of cotton for the production of explosives; war geology, and the mushroom and its dangers.

The Largest Oil-Burning Steamers

THE Panama Pacific Line has just announced that oil-fuel will be installed to replace coal in the furnaces of the twin-screw steamers "Finland" and "Kroonland," now engaged in the 17-day run with passengers and freight between New York, Los Angeles and San Francisco, through the Panama Canal. The necessary changes will be made during November and December at the Robins Drydock, Brooklyn, where each of the vessels will be equipped with the White Mechanical Low Pressure Fuel-Oil-Burning System. Besides assuring cleanly decks and eliminating smoke, dust, cinders, coaling delays en route, etc., the introduction of oil-fuel will produce not only additional but also more continuous speed than is possible with coal, as well as effecting a 40 per cent reduction in fuel bills and a decrease in the fireroom staff from 60 men to 12.

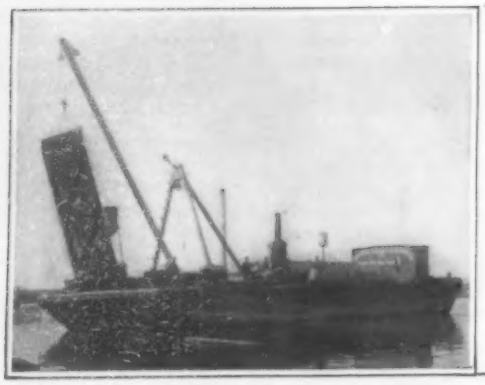
It is interesting to note that the "Finland" and "Kroonland" are the largest steamers ever to be equipped in this manner, being 580 feet long, 60 feet broad, with a displacement of 22,000 tons, and as the fuel will be stored in their double-bottoms, this will make available one third additional cargo capacity, now used for bunkering.

The White system has worked so satisfactorily in the furnaces of the coastwise steamers "Bunker Hill" and "Massachusetts" and in the fleets of the Standard Oil Company of New York, the Texas Oil Company, and others, that the changes in the "Finland" and "Kroonland" will be watched with much interest in marine engineering circles.

Alcohol and Fodder from Wood

BY proper treatment alcohol can be produced from wood, and the residue may be made to yield a product sufficiently nutritious to serve as fodder for cattle. When mixed with their ordinary dry fodder, it is said to be readily eaten by them. Dr. Joseph König, in a recent number of the *Chemiker Zeitung* (Cöthen) says: "Materials containing cellulose, especially wood of all sorts, is first treated with dilute mineral acid (hydrochloric or sulphuric) and dilute alkali, preferably ammonia, or with one of these solvents alone and subjected to heating at changing temperatures. The material is then treated further by the well-known sulphite process. The resulting sulphite lye is completely neutralized and sufficiently aerated, and is then subjected, either alone, or, still better, mixed with the first liquid extracted (which is rich in sugar or gum) to the usual process for making fodder (D. R. P. 265,483). Or if the first extract has been utilized for obtaining alcohol or some other by-product, the residuum is used to mix with the sulphite lye."

From numerous experiments it was found that 100 kilograms of wood yield an average of 4 to 5.5 kilograms of alcohol. The subsequent mixing with calcium sulphate yields from 8 to 15 per cent of organic matter, according to the kind of wood penetration. About 100 grams of the paste, worth about 10 centimes (2 cents), is required per square meter. The material thus treated is impervious to rain, and easy to clean.



Concrete river-bed layer, with the apron raised

Paving River-Beds With Concrete

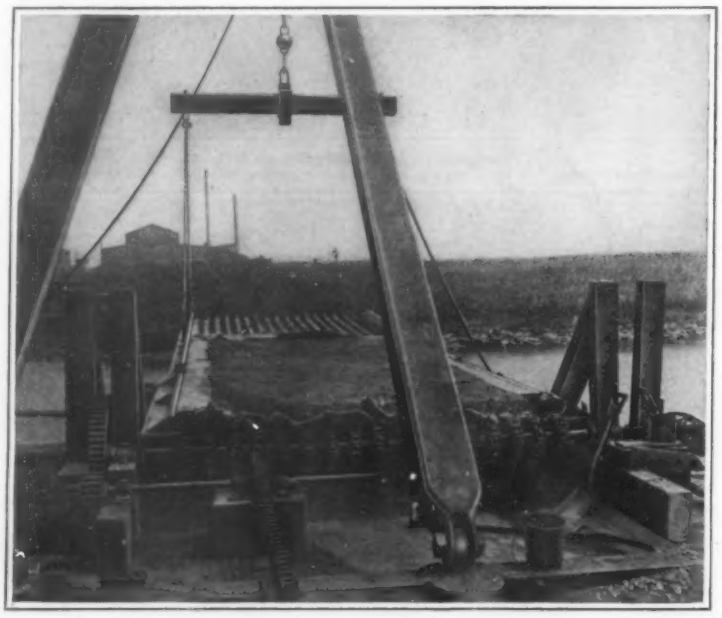
New System of Laying Concrete Floors and Walls to Confine River Waters to Their Course

Concrete slab on the apron being sunk

THE necessity of providing an economical method of protecting farming lands annually subjected to the overflow of rivers during spring floods, and the prevention of the great losses consequent thereto, have become a national issue. During such floods the rivers cut new channels, undermining embankments and levees, and, overflowing their banks, flood large areas of adjacent land. The immense losses inflicted as well as the misery of those rendered homeless through these floods are too well known to require further elaboration here.

The method which has heretofore been adopted for the protection of river-beds makes use of willow bough or brush mats, weighted down with stone in order to hold them on the river bank or bed. In some cases, large slabs of reinforced concrete have been used from above the water level to the top of the river-bank. Nevertheless, while the mats offer momentary protection, consequently involving a high upkeep cost constantly to care for them, a more substantial construction has been found necessary. Until recently there has not existed an efficient method of laying concrete revetment below water, hence all work with concrete has by necessity been confined to applications above water level.

By a system a special concrete covering is made on the deck of a barge and, while still in a plastic state, is projected over the end of the barge by means of an apron. The apron is hinged at one end to the barge, while its lower end rests on the bed of the river. By means of special machinery the covering is moved from the deck of the scow down the apron and spread on the bed or the bank of the river. The subaqueous covering can be made of various widths, lengths and thicknesses, as requirements may dictate, and laid either in a "green" or plastic state to harden in place on the bed of the river or allowed to harden in the air and then placed in slabs on the river bed.



Near view of the apron from its hinged end, showing the driving sprockets, sprocket chains, and a concrete slab on the apron table

The machine for laying concrete beds consists of a barge mounting an apron which, as stated before, is hinged at its inner end to the deck of the barge and at the other end is free to move up or down. The apron is designed to float on the surface when not engaged or loaded, and its outer end can be raised or lowered by means of cable and tackle operated by a steam engine. The table of the apron is floated by means of a number of air tanks which not only serve as the floats, with a displacement just sufficient to carry the weight of the table when not loaded, but also as girders on the apron structure.

The function of the table of the apron is to lower the prepared covering to the river-bottom and pay out this covering in the case of green, plastic concrete, or to discharge a slab quickly and allow it to drop in place when handling concrete slabs or other coverings made and allowed to harden before being deposited below the surface of the water.

In back of the hinge of the apron, on the deck of the barge, is a fixed table on the top of which are parallel rows of sprocket chains containing projections at regular occurring intervals. These sprocket chains are endless and pass over sprocket wheels fitted on a driving shaft. The

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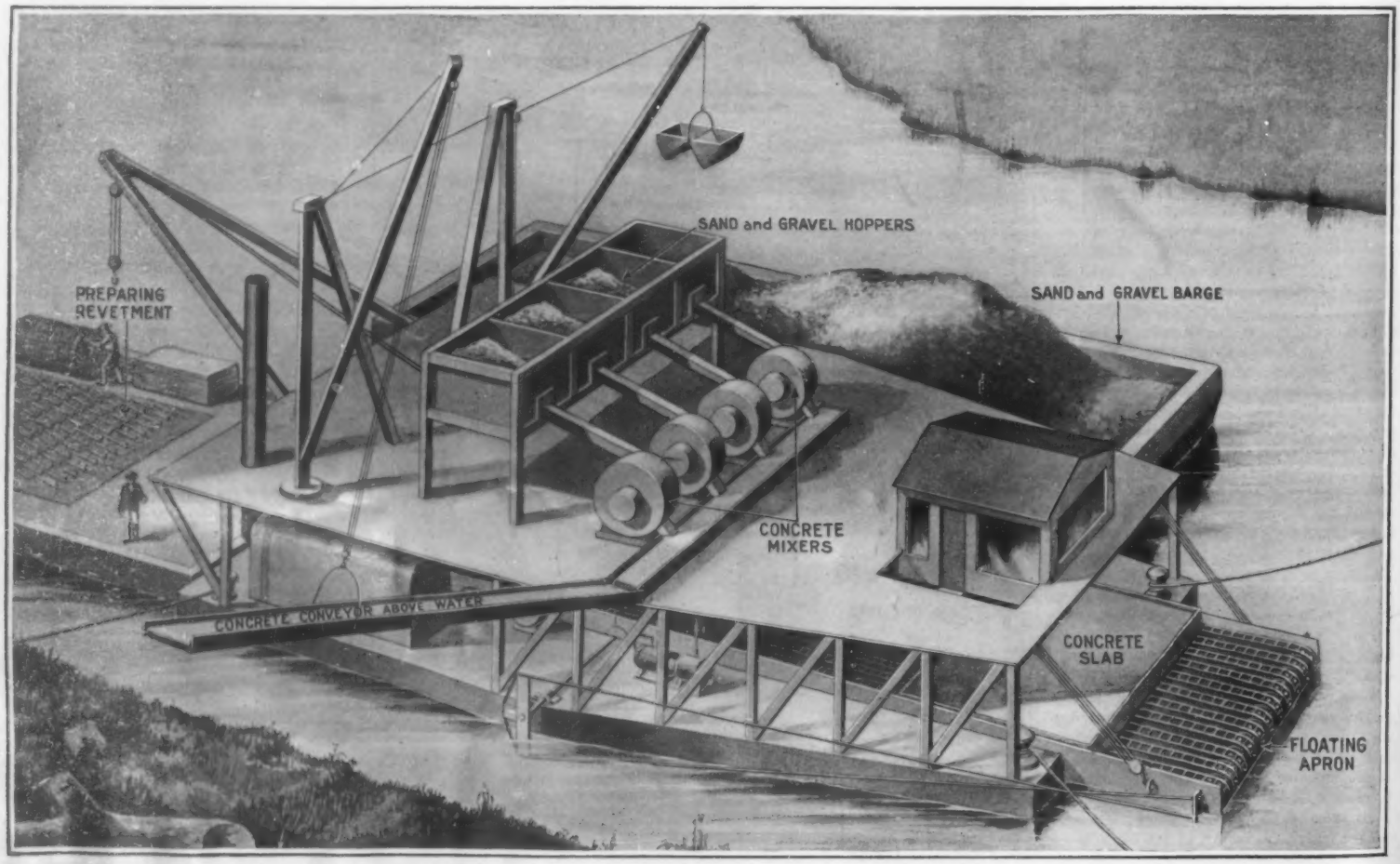

General view of a typical equipment for preparing and laying concrete coverings on river-beds and embankments

The Gyrotelescope

By C. Dienstbach

BALANCING an aeroplane presupposes that the pilot knows the horizontal and vertical directions. The eye cannot always tell these; it is easily deceived, as experienced for instance by the passengers of a street car going down an unusually steep grade to whom all houses suddenly look like "leaning towers of Pisa," just as factory chimneys are known to have looked to aviators suddenly emerging from a fog. Nor can the birds high above the ground, in mist, clouds and at night depend on their excellent vision, for experiments on pigeons have demonstrated that the fluid in the delicate "labyrinth" of their ears acts as a sensitive inclinometer (the nerves very subtlely differentiating between gravity, centrifugal force and accelerations) without which, by force or habit, they cannot even balance next to horizontal ground.

That our aviation virtuosos after a decade of apprenticeship have finally learned to fly miles above the earth, in impenetrable fog, in dark nights, proves that the human ear may eventually equal the birds', just as some savages' mysterious "sense of locality" equals that of animals. For military purposes this balancing may prove about as efficient as the services of an Indian guide in the wilderness. But wherever the slogan must be "safety first," the call for a reliable mechanical inclinometer has been persistent. Yet would-be inventors experienced once more the infinite superiority of natural over mechanical "sensing," because no inclinometer based on the principle of the birds' "fluid level" (pendulums are essentially the same) could be made to differentiate between gravity, centrifugal force and accelerations. As often, in the history of invention, salvation came in applying instead the very "unnatural" principle of rotation. As a proof of this the ingenious gyroscopic inclinometer invented by Mr. E. Sperry seems now so indispensable to the safe aeroplane that its use ought to be made obligatory by law.

Any inclinometer may be mechanically connected to the balancing rudders and as an "automatic stabilizer" maintain the machine in a horizontal position as long as the wind's vicissitudes grant these rudders a sufficient grip on the air. But Orville Wright has recently explained why a horizontal position neither saves the current type of aeroplane from falling nor (and this is more serious, as with efficient rudders, mere parachuting—"pancake" falling—would soon be retarded and stopped by the motor) maintains the rudders' grip on the air, if the machine, by the pilot's fault or by the lulling winds, lost its relative velocity through the air, which the motor cannot restore in time against its inertia, before the *virtually rudderless* machine begins to plunge edgewise and gyrate. So the gyroscopic *automatic* stabilizer, except as a closely supervised helper and saver of physical exertion to the pilot, would yet seem a bit premature. But as an ideal inclinometer it goes a long way towards not only making flying safe, but also no more difficult than running an automobile.

Paramount as be the use of the gyroscopic indicator of the horizontal and vertical direction as a safeguard, it becomes a *conditio sine qua non* if missiles are to be aimed with precision at long range from the air, be it in a more vertical (in bomb dropping) or a more horizontal (in shooting) direction. The slightest error in guessing what the instrument shows so accurately inevitably sends the bomb, bullet or shell wide off the mark. No wonder bomb dropping, except at low altitude, has been so erratic and firing at long range hardly been attempted. It is for this reason that Mr. Sperry has recently completed a gyroscopic sighting instrument. It consists of his well-known apparatus so

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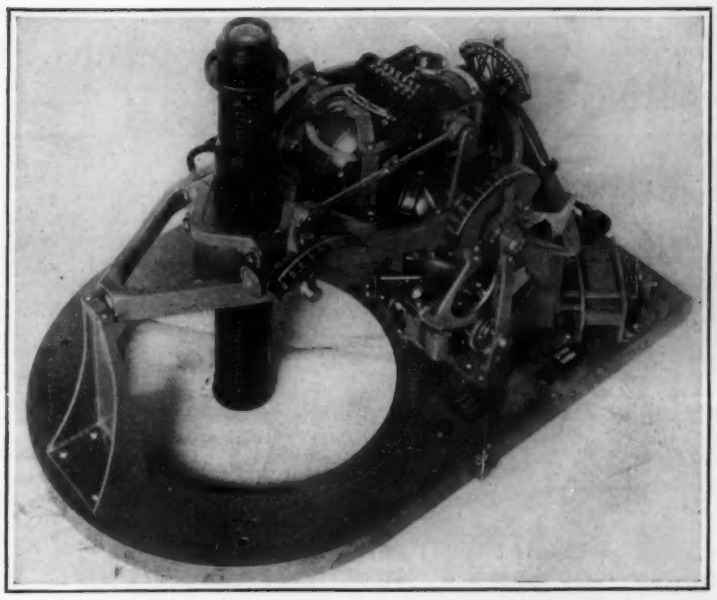
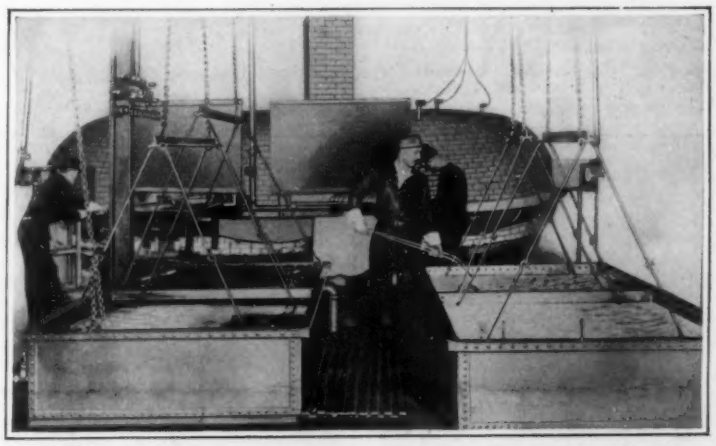
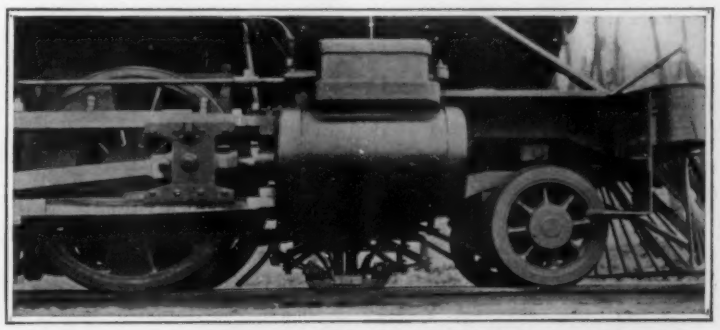


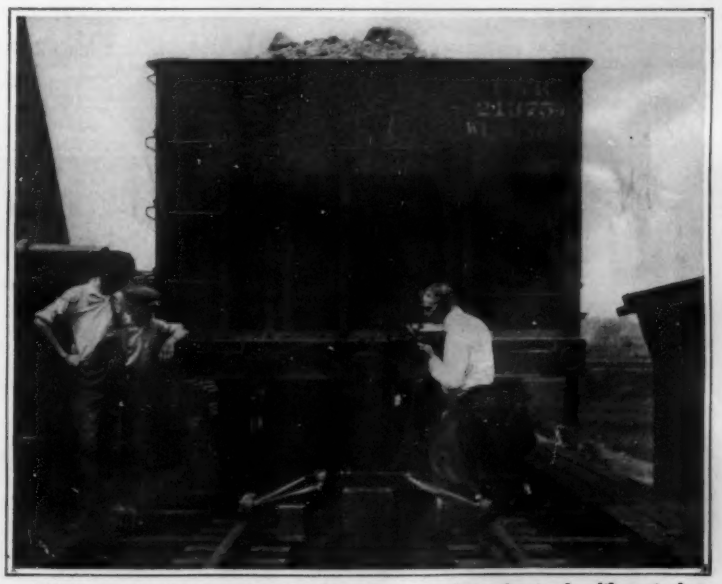
Sperry Gyrotelescope, which permits of the accurate aiming of bombs and gunfire on board airships



Oil-burning furnace for heat treatment of automobile springs, and oil baths for hardening the steel



One of the two copper shoes used in making contact with the steel rails, for conveying current to the locomotive cab



Holding a telephone conversation between two points of a track with a steel car intervening

Oil-Burning Furnace for Heat Treatment of Automobile Springs

IN order to secure the continuous and absolutely constant temperature required in the heat treatment of automobile springs, a Detroit firm has recently installed an oil-burning rotary furnace in its shops. The new furnace, designed and built by the plant engineer, is the only one of its kind in the world. It is comparable in shape to the head of a gigantic mushroom, being 26 feet in diameter and 81.7 feet in circumference.

Springs to be heat treated are placed on the revolving floor of the furnace, which makes a complete revolution in from 20 to 30 minutes. The rate of movement of the revolving floor may be regulated by altering the control of the variable speed motor which drives it. Jets of air and fuel oil placed at intervals around the outside circumferences are forced through vents left in the walls into the furnace at a great velocity. The oil is ignited through contact with the heated interior of the furnace, and maintains a constant temperature of from 1,450 to 1,575 deg. Fahr. Ten pyrometer couples register the temperature, and an electric signal board notifies the operator whenever the temperature either rises above or falls below the set limits.

In treating a large output of springs in the old type of furnace, it was necessary to heat the chamber to a considerably higher temperature than that required for the springs themselves. The steel springs were brought to the required temperature quickly and removed before they became too hot. The rotary furnace, in marked contrast, is heated only to the temperature required for the treatment. The steel attains this heat slowly, remaining in the furnace until it has reached the exact temperature desired. There is no opening and closing of doors to cause intermittent draughts and make the heat difficult to control, only one door being employed to load and unload the new furnace.

One crew of men operating the oil-burning furnace is kept busy removing the heated leaves as the revolving floor brings them into position, while another crew inserts others to take their place. The leaves to be treated are placed cold on the revolving floor and during the operation they gradually attain the maximum heat of the furnace. At the end of the revolution they are removed from the furnace and hardened in oil baths; the oil being kept at an even temperature through the agency of an air and water cooler circulating system which maintains a temperature of from 90 to 120 deg. Fahr.

After leaving the bath, the springs, which have previously been treated in the rotary furnace, are passed on to the "draw furnaces." Passing through these furnaces on an endless chain conveyor for 30 minutes, during which period they are subjected to a maximum temperature of about 100 deg. Fahr., the "temper" or hardness is modified to give the metal the necessary textile strength and ductility required by the severe conditions imposed on an automobile spring.

Railroad Tracks as Conductors for Telephonic Communication

FOR some time past a Philadelphia man, W. W. MacFarland, has been conducting a series of experiments in the use of railroad tracks as conductors for telephonic communication. It is claimed that telephone conversations over the steel rails of the Pennsylvania Railroad have already been held between New York and the experimental station near Philadelphia, and that the messages were then relayed to the local Bell telephone company's wires.

The method employed by MacFarland is not unlike that utilized in passing electricity through the rails in signal practice. For the present, however, the inventor does not wish to fully explain his system owing to some patent controversy.

(*Concluded on page* 365.)

Inventions New and Interesting

Marksman using the new steel shield

Steel shield dismantled, ready for carrying

Patent Office News Notes for Inventors

Steel shield mounted on a military rifle

Portable Steel Shields for Protection of Military Marksmen

AN American inventor has devised a compact, portable shield that is intended to protect military marksmen against the rifle and machine gun fire of an enemy, especially during an advance in skirmish order across an open field.

The shield proper is made in two pieces which may be disconnected and packed together to facilitate carrying it about as part of a soldier's equipment. It can be slipped over the barrel of a military rifle and held firmly in place by two supporting rods that fit into two small metal blocks screwed on the rifle. When in position, the steel shield slopes back at a sharp angle, tending to deflect any bullets that may strike it and thus giving greater powers of resistance to the tough steel walls. A notch in the bottom of the shield accommodates the rifle on which it is mounted, while a vertical slit above it enables the marksman to sight the firearm.

While comparatively inexpensive to manufacture and adding but little extra weight to the equipment of a soldier, a shield of this kind would result in making skirmish attacks less costly in human lives than they are at present. Already shields of a similar kind are being employed by the soldiers engaged in the European war, although their shields are usually much larger and not so well adapted to skirmishing operations.

Meter for Measuring Rate of Flow of Compressed Air

BASED on the well-known law deduced by the French scientist Poncelet, which is, briefly, that "the volume of a definite compressed fluid or gas flowing under small, constant head through multiple orifices of the same shape and size is directly proportional to the number of orifices exposed to the flow," a meter for measuring the rate of flow of compressed air has recently been devised. It is especially intended for measuring the air consumption of any pneumatic tools or machinery or other application of compressed air, as well as the actual, net production of air of any compressor or pump within the capacity of the meter.

The new compressed air meter, a cross-section of which appears in the accompanying illustration, has for its main feature absolute simplicity. There is but one moving element which floats on air and is consequently frictionless and non-wearing, insuring accurate readings during years of service. The moving element is in the form of a weighted piston in the upper or metering cylinder, a small piston in the oil dashpot cylinder, and a rod joining the two pistons and extending upward where it moves freely, without contact, inside the sight glass at the top of the meter. The uppermost rod, rising and falling with the pistons, indicates on a dial calibrated in cubic feet of free air per minute the flow of air through the meter. The meter is direct-reading; its employment does not involve calculations of any kind.

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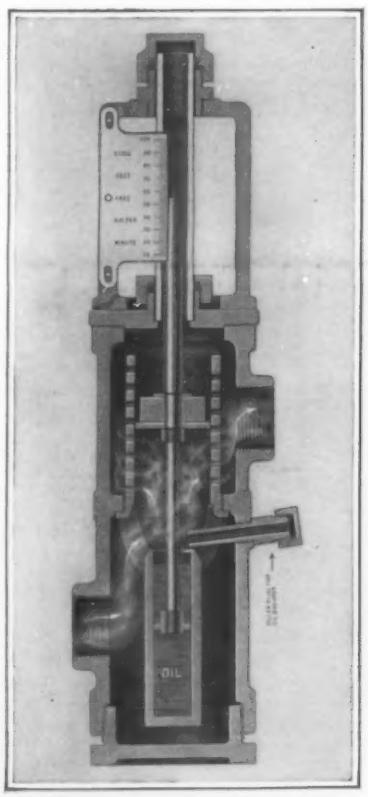
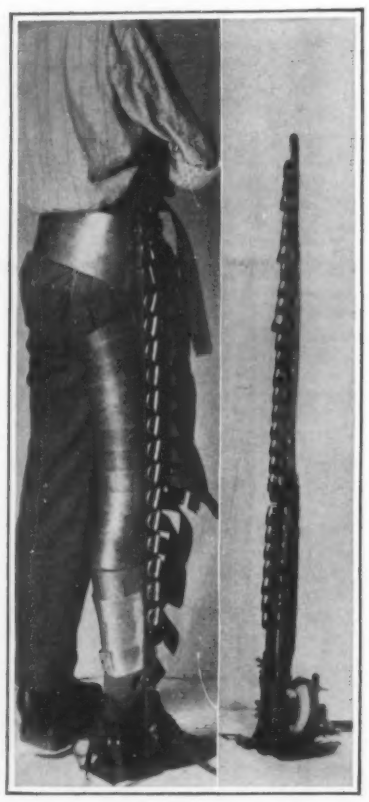


Cross-sectional view of compressed air machine based on new principle



Device for treating fractured limbs and how it is used

Electrical Ball Pitchers for Indoor Batting Practice

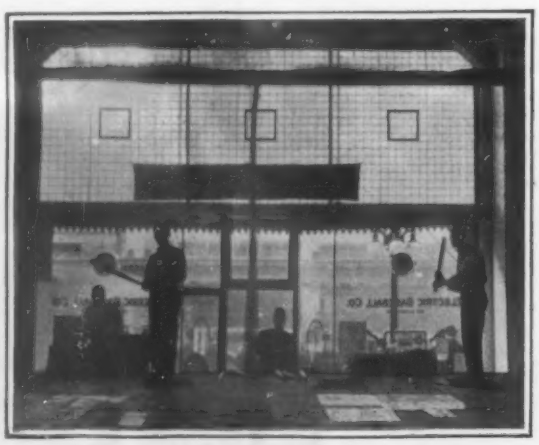
BATTING practice throughout the year is now rendered possible by the introduction of an electrical device for pitching baseballs. The device may be installed indoors, surrounded by a netted cage, so that America's favorite sport may be indulged in at any time and in any weather.

Heretofore, baseball players have not taken up the bat during the winter months, and as a result the following summer found them somewhat out of practice. But with the introduction of his new device the inventor predicts that there will be a revolutionizing of baseball, making necessary a readjustment of the balance of power between defense and attack, just as in the case of football a few years ago. He points to Brickley, the Harvard football player, who became a great drop-kicker because he practiced for hours every day all through the summer and winter as well as in the fall.

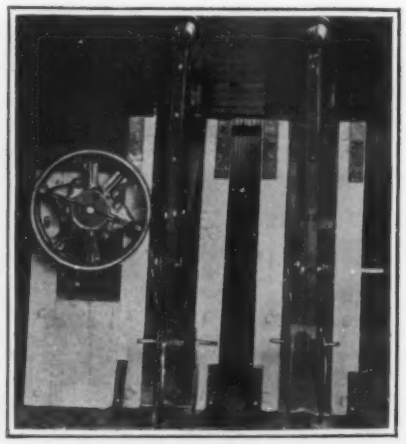
The new invention is in the form of two catapults, operated by a one half horse-power electric motor and capable of throwing individually one ball at a time. The balls are thrown in the direction of two batters who stand at the farther end of the netted cage. The machine can be adjusted for speed, slow balls, "hooks" and "fade aways"—even the so-called "emery" ball is within the province of this mechanical ball-pitcher's skill.

The batters hit the balls back toward the machine and against canvas backstops of which there are four, hung one in back of the other. The first canvas is about 2 feet high and a ball hit against it counts for a single; the next canvas, hung in back of the first and higher, counts for two-baggers; the third canvas, still further back, counts for triples, and the top canvas, much farther in the rear and more inaccessible, is for home runs.

The floor of the cage is built higher at the batters' end so that the balls run back to the machine automatically. No attendants are required to operate this indoor baseball game once the pitching machine is adjusted.



Batters at far end of netted cage, waiting for balls to be thrown



Machine for throwing baseballs, operated by one half horse-power motor

New Device for Treatment of Dislocated and Fractured Lower Limbs

A NEW YORK surgeon has recently perfected an apparatus designed to treat fractures to the lower limbs as soon as possible after they have occurred. The apparatus is especially intended to meet emergencies and complicated conditions. It may be employed in fractures, gunshot wounds, luxations and dislocations. It may serve as a temporary splint instead of a spica, or again it may be employed as a permanent splint, depending upon the advisability of recumbent or ambulatory treatment.

The device consists essentially of two flat steel bars attached at their lower ends to a rectangular foot plate. To the external rod are riveted a series of from 12 to 15 thin aluminum bands which are curved to fit any lower limb around which they may be placed. The bands are fitted with straps so that they may be tightly held in place. By turning the bands 180 deg. the apparatus may be placed on the other limb. An ingenious foot arrangement enables the patient using such a device to exert a tractive effort to a considerable degree without pain. The entire device weighs but 8 pounds.

(Concluded on page 365)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers

WEED CUTTING MACHINE.—OSCAR HJALMAR BJUR, R. F. D. No. 1, Kennewick, Wash. This invention relates to an improvement in weed cutting machines in the form of a mechanism for separating a strip of soil from the remaining soil, and other mechanism for cutting beneath the strip and removing the soil in sections; the second mechanism being arranged to deliver the cut soil to a conveyor, which in turn delivers it to a dropper that may be operated at will to drop the load at any desired point.

CRANK AND LEVER MECHANISM FOR WINDMILLS. — HENRY KALLIS, Wessington Springs, S. D. The invention relates to windmills and more particularly to certain improvements in mindmills relating both to the means directly through which the power is developed and also to the means associated therewith for directing and controlling the application of such power to the practical use for which windmills are generally intended. A further object of the invention is to provide a simple and novel means by which the developed power may be divided and transmitted to a plurality of transmission devices and subsequently adapted to other uses of the same or different characteristics.

Household Utilities

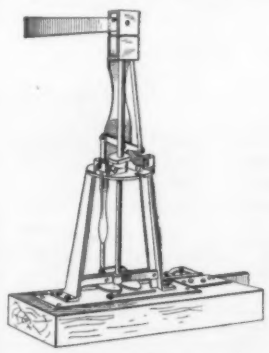
TOOTH-POWDER DISPENSER.—ROBERT D. GEE, 31 N. Main St., Blackfoot, Idaho. This invention is in the form of an improved tooth-powder dispenser and has for its object to provide a device that may be fastened to a fixed support, is provided with a compartment for containing tooth-powder as well as another compartment below it for receiving the brush; a port being arranged between both compartments and fitted with a valve which normally closes the port by pressure of a spring. Insertion of the tooth-brush pushes back the valve against pressure of the spring and opens the port, sprinkling the tooth-brush with tooth-powder.

SANITARY SUGAR CONTAINER. — WILLIAM GOLDFARB, 64 Clinton St., New York, N. Y. This invention relates to devices for retaining and dispensing commodities and has particular reference to a container for lump sugar and means for dispensing the lumps singly in rapid succession. Among the objects of the invention is to provide a container for a large quantity of sugar in proportion to the size of the apparatus, and provide means for keeping the contents sanitary, free from contamination of any sort.

IRONING BOARD.—CHARLES O. BROWN, 109 7th St., S. E., Minot, N. D. This invention relates to an improvement in ironing boards and has for its object to provide an ironing board that may be clamped to a table top and supported at the other end by an adjustable leg resting on the floor or the like. Access is had to the top and bottom of the board, and there is also provided an auxiliary board that is detachably connected to the main board. Adjustments are provided for altering the height of the board as well as levelling it.

Of General Interest

SWITCH STAND.—SMITH F. PHILIPS, in care of D. F. Beckham, Court House, Chattanooga, Tenn. This invention has for its object to provide a mechanism in connection with switch stands for moving the points of a switch to deflect trains from the main track on to a switch, wherein mechanism is provided for locking the switch points in safety or main line



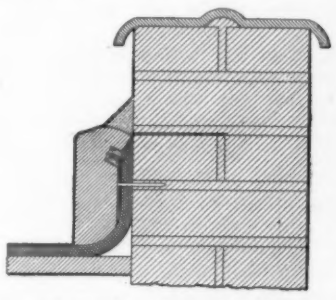
SWITCH STAND.

position and connected to the operating mechanism for moving the points in such manner that when the operating arm for the switch is moved into inoperative position after returning the points to normal position, the locking mechanism will be operated to lock the points against movement.

METHOD OF PRODUCING COMBUSTIBLE GASES.—DR. HUGO STRACHE, VI Theobaldgasse 15, Vienna, Austria-Hungary. This invention relates to a method of producing a gas composed of distillation gases and water gas, consisting in consecutively producing coil distillation gases by hot blasting coal contained in a distilling chamber arranged in the generator, accumulating said distilling gases in the distilling chamber, forming water gas by steam blasting, and displacing the distillation gases by the water gas of hot blasting operation.

GOLD PEN.—WILLIAM I. FERRIS, in care of L. E. Waterman Company, 173 Broadway, New York, N. Y. This invention relates to a double-point gold pen with points disposed respectively on the obverse and reverse sides so that fine and coarse lines can be made at the will of the user. The specific object of the invention is to so construct the split of the pen that ink will flow freely when using the point of the obverse side.

FLASHING FOR PARAPET WALLS.—FELIX D. RENAUD, 545 W. 31st St., Chicago, Ill. This invention relates to flashings and it has for its object to provide an inexpensive and



FLASHING FOR PARAPET WALLS.

durable flashing particularly well adapted for protecting felt and similar roofs where they join a parapet wall. This flashing is of a durable nature, effective, inexpensive to manufacture and may be made use of without employment of skilled labor.

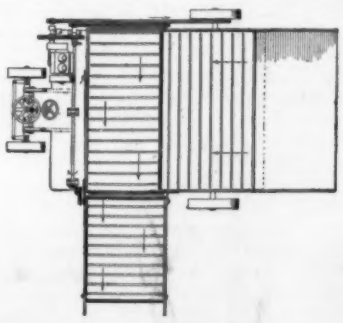
BUILDING STRUCTURE. — PAMPHILUS SCHMITZ, Phoenix, Ariz. One of the main objects of this invention is to provide improved means for the construction of fireproof walls or partitions having the desirable dead air spaces. Another object is to provide a partition or wall including sheet metal studding having means for connecting them to the ceiling or floor of a building, and adapted to be utilized in connection with composite concrete blocks or boards; the studding being provided for maintaining and anchoring the blocks or board in place. The construction is extremely simple, durable, efficient and inexpensive to manufacture.

Hardware and Tools

HACKSAW HOLDER.—HENRY N. WELLS, Riverhead, N. Y. This invention relates to hacksaws has particular reference to means for holding hacksaw blades or serviceable pieces of hacksaw blades for practical operation. Among the objects of the invention is to provide a holder easy to manipulate for inserting or removing blades, and to provide a holding device serving as means to gage the depth of cut of the saw, such gage means being accurately adjustable. The holder may be used for any hacksaw blades, irrespective of their length.

Machines and Mechanical Devices

SNOW REMOVING DEVICE.—OTTOM M. ECKARDT, 17 South Essex St., Dover, N. J. The invention is an improvement in snow removing devices and has for its object to provide a self-propelled and self-operated device wherein a wheeled supporting frame is provided, having a scoop for picking up the snow and having conveyors for receiving the scooped up snow and delivering it at a distance from the place where it has been taken up.



SNOW REMOVING DEVICE.

CARBURETER.—HARRY C. MERRIAM, The Woodstock, 125 Peterboro St., Detroit, Mich. The invention relates to carburetors for internal combustion engines and has for its objects the following: To provide means for supplying the fuel mixture under pressure; to accomplish the aforementioned result by means of a fan interposed between the spray nozzle and the intake manifold, the fan also serving to vaporize the mixture and separate the impurities therefrom; to provide a screen for assisting in the last mentioned results; to provide means for supplying auxiliary air to intake manifold as speed of engine increases; to provide means for increasing fuel supply in the degree of engine requirement. The devices for the means mentioned are simple in construction and operation, small, compact and inexpensive.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Paving River-Beds With Concrete

(*Concluded from page* 362.)

table is covered with sheet iron and the sprocket chains are moved in unison by the power of a steam engine applied through clutches. The sprocket chains are also under the control of brakes. The other end of the table is equipped with guy cables passing to the hinge on each side of the barge, the object of these guys being to steady the apron structure and prevent torque on the hinge shaft through the action of the flowing water and tides, as well as surge guys fastened to arms turning on the hinge centers.

The engine carried by the barge lowers or hoists the apron when so desired. It also moves the sprocket chains that serve as carriers of the covering placed on them, discharging the coverings at the submerged end on the bed of the river. The same boiler that supplies steam to the engine also supplies power to operate a hoist sprocket chain conveyor, cement mixer, air compressor and steam capstans.

The barge carrying the equipment is preferably of the catamaran design, so that the apron can be hinged near the center of the craft, yet remain free to be lowered into the water. Sections of the barge deck extend as arms on either side of the apron, as may be seen in the illustration that shows the mechanism of the entire equipment. The air tanks, either of rectangular or tubular shape and which form part of the structure of the apron, are fitted with valves and, by means of compressed air supplied by a compressor, may be adjusted to the desired buoyancy. Water can be admitted into the tanks to sink the table; the reverse operation being accomplished by driving out the water under air pressure from the compressor. The valves are located on the deck of the barge where they can readily be operated.

In order that the concrete river-bed layer be self-contained and capable of handling its work in the most expeditious and inexpensive manner, the barge also carries concrete mixers and the necessary conveyors and hoppers for the preparation of the river-flooring. It is generally necessary to use a second barge, providing more space for carrying the revetment and preparing it for the river-bed, and even other barges containing sand and gravel.

The operations in laying a concrete river-bed with such an equipment are as follows:

On the deck of the barge is laid a covering of gunny or burlap of the desired dimensions. On top of this is placed a crimped wire mesh of the necessary width and length. The wire mesh is fastened to the gunny cloth and is so bent or crimped that it serves to hold the concrete in place while the entire mass is being moved down the steep incline of the apron, after which it becomes the permanent reinforcement member of the concrete river-bed.

The covering is then drawn to the platform table and concrete poured over the burlap and reinforcement mesh from a mixing plant located on the upper superstructure. The concrete is spread out and rolled down to the proper thickness by means of a scraper and roller, preferably and usually 4 inches. The covering thus made is then run out on the apron and conveyed down the incline to the river-bottom. As fast as the covering is prepared it is paid out on the bed of the river by releasing the cables fastened on shore from the steam capstan and hauling in cables made fast to anchors out in the stream and controlled by other steam capstans. The operation is continuous, and large areas of subaqueous surfaces can be covered with a plastic, flexible, reinforced concrete carpet in a remarkably short time.

In laying a concrete slab made in the air and allowed to harden before being placed in the water, the slabs are formed on the barge deck. These slabs are drawn on to the table by hoists until they are engaged by the carrier chains, carrying them to the end of the apron which is maintained in a horizontal position. The slabs are discharged horizontally into the water by the rapid movement of the carrier chains and, owing to their natural buoyancy because of the large surface presented to the water, sink to the river-bed without rupture.

Railroad Tracks as Conductors for Telephonic Communication

(*Concluded from page* 363)

The remarkable feature of the system is that the electric current used, instead of passing through the wheels and axles of the rolling stock standing on the tracks, which offer a shunt path of fairly low resistance, will pass in sufficient strength through the apparatus to satisfactorily perform the task set for it. This is brought about by furnishing a path of least resistance to the current.

In the new system, current is conducted from the rails to the cab of a locomotive by means of a shoe of copper held in a steel frame and resting upon each rail. The current, in addition to rendering telephonic communication possible, can be used for other purposes, particularly for signalling.

In the way of a striking demonstration of the practicability of his system, the inventor recently connected one station to the rails of a side track, near the end of a steel coal car, and placed a receiving station on the rails near the other end of the car; copper shoes of identical design to those used on the trains being employed to make contact with the rails and conduct the two-volt current to the apparatus. Regardless of the steel freight car standing upon the tracks between the transmitting and the receiving stations, successful communication was obtained.

In the regular installations of the system it is planned to supply the current from batteries located along the tracks and to make connections at the same points with the telephone wires. It will be possible to reach a train and hold telephonic conversation with it irrespective of where it is stationed.

New Device for Treatment of Dislocated and Fractured Lower Limbs

(*Concluded from page* 364.)

Briefly, the advantages of the new device may be summarized as follows: The limb is held in absolute immobilization, redression and traction; ambulatory treatment is possible; observation of callus, dressing, drainage, massage and electrical treatment are possible, without removing the splint or lessening the traction; the apparatus is light and compact and can readily be made a part of any ambulance equipment; very little skill is necessary to apply it; practicability in post-operative treatment instead of spicas, and, lastly, it does not interfere with X-ray examinations.

Meter for Measuring Rate of Flow of Compressed Air

(*Concluded from page* 364)

Air enters the meter at the lower left-hand opening into the chamber surrounding the dashpot cylinder and passes through ported openings into the interior of the metering cylinder, the wall of which is drilled with a large number of small, accurately reamed and uniformly spaced holes. To pass to the outlet chamber the air lifts the piston and exposes some of the holes to the flow. A small "head" or difference of pressure is established between the interior of the cylin-

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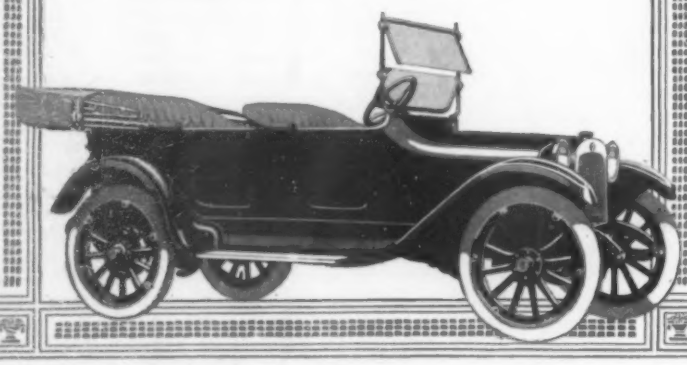

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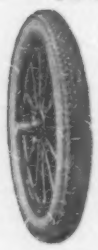

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der and the outlet chamber; this difference of pressure—only a few ounces per square inch—being fixed by the exact weight of the moving element and the area of the piston on which the difference in pressure acts. The moving element rises until the weight is exactly supported by the difference in pressure; the pistons and rod then floating in static balance in a position corresponding exactly to the volume of air flowing, the number of holes exposed and the height of the top of the rod in the sight glass. The divisions of the scale plate are calibrated by comparison with a standardized instrument to read correctly.

The new meter is not a velocity meter which would give readings proportional to the square of the volume flowing. Instead, it is a direct volume gage with a uniform scale on which 1 cubic foot is represented by the same distance whether working at low or high capacity. The loss of pressure represented by the insertion of a meter of this kind in a pipe line is so slight that it cannot be detected by a gage. The meter is not injured by a flow in excess of its metering capacity.

Fall River's Proposed Water Supply System

(*Continued from page 353.*)

crete, without doors, windows or transverse partitions, a mile and a half long, while its width and height are approximately equal, about 25 feet. In magnitude it is equivalent to a two-track subway of equal length. From this to tide water there is planned an outlet sewer of rounded outlines about 6 feet square and three quarters of a mile in length. This it will probably be necessary to cut through the foundation granite of the city.

The three channels of the main conduit will be devoted, as the section diagram suggests, to the cold water supply for the mills, the warm water return from the condensers, and the surface drainage. As the district increases in population, the sewage can be cared for by a trunk sewer in the foundations of the conduit, and other utilities, such as gas and electric wires, can readily be placed in the walls of the conduit if it should prove expedient.

The cold water conduit is to be at the bottom of the structure, a single or divided channel with a cross section of about 110 square feet at the intake and one half that size at the lower, closed, end. It will be level, the pond pressure keeping it filled.

The warm water return, the uppermost canal, will have a gentle pitch back towards the south pond, about 2 feet to the mile, its capacity increasing as it nears the pond. The water will enter an oil-separating basin, and thence through a cooling basin which will be large enough to hold about one half the day's discharge into the south pond. The afternoon's return it is proposed to hold here through the night. The basin, which will be excavated in flats and waste shore land, will be eight acres in extent and about 6 feet deep.

The central conduit, that for surface drainage, will have a cross section of 120 square feet, and will be capable of handling the surface discharge of the area, estimated in the most violent rains to be some hundreds of millions of gallons. It will connect at the inward end with the outfall sewer, and this with its steep pitch can carry away all that the conduit will receive. The canal is level and is stopped at the pond end by a half-height partition. In cases of great emergency the surface water can here be discharged into the south pond, making of the whole construction a conduit flowing four ways at once. It will serve also as emergency outlet for floods in the pond. These, at the present time, with the Quequechan as an outlet, flood the shores with more or less injury to property. The drainage canal under such circumstances will be occupied for a few hours in caring for the storm water as it falls, the run-off to it being enormously quick, and when this has abated the pond will be beginning to feel the effects of the precipitation on its water-

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All communications are strictly confidential. Our vast practice, extending over a period of more than seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc.

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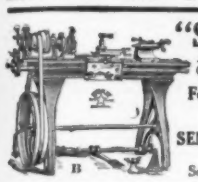

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Its remarkable physical property is that *it will remain sticky or viscid when fully exposed to the wind, sun, rain, etc., from ten to twenty times as long as any other known substance.*

Its long continued pliability should make it valuable to fill cracks in cement or any valuable timbers exposed to the weather, such as piles. Also for making riveted iron work tight as in boats, tanks, etc., it should prove useful, and in difficult problems of waterproofing

The substance has been named Tree Tanglefoot because it has found quite an extensive use as a banding material for trees to prevent the ascent of injurious caterpillars or other insects, particularly gypsy and brown-tail moths, tussock moths, cankerworms, fall web-worms, ants, etc. It is also the best possible application after pruning or tree surgery. It will waterproof a wound or even the crotch of an old tree when nothing else will do it.

The manufacturers invite correspondence from anyone who might be interested.

THE O. & W. THUM CO., Grand Rapids, Mich.

shed, and this in turn can be cared for absolutely by the same channel.

The connections between the mills and the great conduit will be triple in precisely the same way. There will be narrow conduits about as high as the main one, delivering water under pressure for condenser use at the bottom, returning warm water from the condensers at the top, with storm-water drains for the mills and yards between and in addition the mill sewer for such establishments as have no present sewer connections.

The advantages of this novel construction will strike the engineer at once. There are three functions to be performed. It would be the customary method to lay conduits independently side by side, and usually in cities as separate constructions at different times, each with its own large cost figures. This planning is, however, a true evolution arising from the features of the case, and affording important economy by the triple use of the single construction.

To take better advantage of the south pond for a mill pond and to increase its storage capacity, the engineers propose to double the depth of the outlet and make it drain to 8 feet below full pond level instead of about 4 feet which it does now. Under these conditions the cold water to be distributed by gravity must be in a pipe or conduit that is low. If it were an open conduit the cold water supply would be a stream in its bottom. On the other hand, to deliver the warm water back to the south pond this conduit must be at a slight elevation above the surface of the lake. When these two conduits are placed one above the other the space between them is just where it ought to be for surface drainage, its bottom below the present levels of the stream.

The engineer will also be struck by the conservation idea of the warm water return. But for the oil and a little grit that it may pick up in doing its work, the condenser water is as good as ever for industrial purposes, and it is here possible to use it over and over again. The cutting down of the outlet will increase by about 70 per cent the storage capacity of the south pond, and taken with the return condenser water the engineers are able to assure to the mills a supply of 20,000,000 gallons a day of cold, clean water for every working day in the year, and this without the need of making any draft whatever on the north pond or drinking supply.

At the present time in the freshets, which there are no means of controlling, as much as 150,000 gallons a day have passed down the Quequechan, by far the greatest part going to waste, and on the other hand the summer flow runs as low as 5,000,000 gallons a day. Under the latter conditions the mills have been short of water, they have suffered injury through the dirty water taken in the shallow stream and have indeed been shut down for what has been asserted to be a shortage of water. And this has happened within 2 miles of a lake containing billions of gallons of water exactly suited to mill uses.

There are numerous other details in connection with the plannings, but it is not necessary to enumerate them here.

An economic advantage when the conduit shall have been built is that it will require a strip a few feet in width only in the middle of what are now extended, offensive flats. These flats constitute the nuisance that the State Health Department has decreed must be abated. It is proposed, therefore, to fill in the flats by a wholesale method that will not prove costly. The region is level land in the heart of a busy mill district and there will be gained from the unproductive flats an area of 150 acres, where land is practically sold by the foot.

Another feature that has not yet been touched upon is the better railway facilities which the filling of the flats will assure. At the present moment a railway on a trestle runs down the centre of these flats. Although its tracks all but touch the corners of 30 or 40 mills, still there are only 3 or 4 of the entire lot that have sidings or spurs. However, there will be a spur track into every factory the moment the filling is completed.

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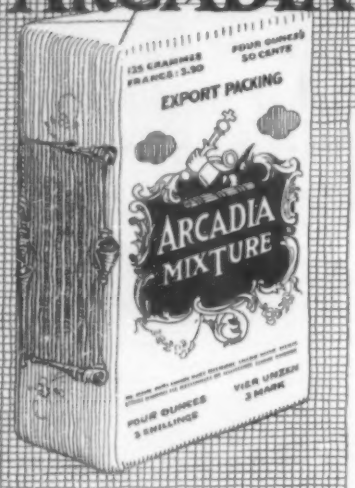

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THE YOUTH'S COMPANION, BOSTON, MASSACHUSETTS

The 350-Mile Astor Cup Auto Race

(*Concluded from page 357*)

increased 100 per cent to allow for impact.

The track structure contains about 3,000,000 feet board measure, of Southern long-leaf, yellow-pine timber, which cost about $27 per thousand, and 1,570 tons of structural steel, which cost about $57 per ton erected in place. There are also 12,000 cubic yards concrete, which cost about $8 per cubic yard.

The grandstand is an enormous structure 1,800 feet long, built of structural steel. It provides a main floor and upper gallery. On the opposite side of the track are timber-built "bleachers," which are also 1,800 feet in length. Opposite the grandstand is a long line of concrete pits, equipped with all the conveniences for refueling the cars, replacing tires, and making such emergency repairs as are possible during the running of a race.

The track was built by the Sheepshead Bay Speedway Corporation, and it was designed and constructed by Blaine H. Miller, formerly chief engineer of the well-known Indianapolis Speedway.

The race itself, run in brilliant weather, was a decided success—except, of course, for the fact that out of the twenty cars which started, twelve were disabled, and of the remaining eight only six completed the full distance of 350 miles. Early in the race it was demonstrated that the Peugeot cars, driven by Resta and Aitken, were the fastest of the twenty starters. Resta was timed for the 22d lap in 65 seconds, which is nearly 111 miles an hour, and for several laps he was running at over 107 miles. He went out with a broken connecting rod after covering 104 miles. Aitken, who moved up to the front, after Resta's elimination, kept up a steady pace of between 104 and 105 miles an hour, and was slightly in the lead, when a cracked water jacket put him out of the race. Burman, in a Peugeot of somewhat less speed than the two preceding cars, ran an extremely interesting race with Anderson and Rooney, who were driving two Stutz cars, but had the misfortune, when he was within two laps of the finish, to suffer from a broken transmission.

The first prize of $20,000 was taken by a Stutz car, driven by Anderson, which averaged 102.6 miles an hour. Rooney, in his Stutz, took the second prize of $10,000, with an average speed of 102.19 miles per hour. Third and fourth prizes of $5,000 and $4,000 were taken by two Dusenburg cars, driven, respectively, by O'Donnell and P. Anderson, at an average, respectively, of 95.45 and 92.21 miles per hour. The fifth and sixth prizes of $3,000 and $2,000 went to an Ogren Special and a Delarge, which averaged, respectively, 91.97 and 84.22 miles per hour. Seventh and eighth prizes of $1,400 and $1,200 were taken by a Sebring and a Mulford Special, which were still running when the race was called off.

The Gyrotelescope

(*Concluded from page 363*)

arranged as to keep a telescope (supported on universal joints) pointed at an unchanging angle to the horizon. By a set screw the telescope may originally be placed either in a vertical position, which is then rigidly maintained, or at any angle to the vertical direction. This means that no matter around what axis the aircraft (or the instrument separately) is made to turn, the only turning movement permitted to the telescope is one which describes in space a vertical cone whose slope is equal to the angle at which the telescope was originally set. The precision of this action is sufficient for any sighting or spotting process, although the best gyroscopic instrument is not entirely exempt from slight periodic oscillations (resulting from mechanical or aerial friction transmitting deviating impulses). But these oscillations are in this instrument of minute smallness and extreme slowness. Each single one takes more than five minutes. In other words, during the seconds required for sighting (or spotting ranging shots from above) the telescope is practically perfectly rigid. Its use for bomb dropping is very simple and has been made quite familiar by Lieut. Scott's experiments, whose sighting telescope differed only by its lack of reliability, because it was crudely controlled by a pendulum. But with this gyroscopic (the novel instrument has given at last a proper meaning to this misfit word which should really read "gyrostatic," as mostly no optics is involved) sighting tube, the precision of bomb dropping ought to exceed that of mortar fire, provided the elevation above the target and the (steady) speed over the ground are accurately ascertained (and maintained), and the bomb's weight is sufficiently great in proportion to surface to make them immune to ordinary cross winds. It is evident that, with the advent of a reliable sighting instrument, the mammoth dirigible will become the true fighter of the air, superior to the aeroplane squadron, because it will be better to drop fewer and heavier bombs with precision than many which are deviated by cross winds. A dirigible may be equipped with several gyrotelescopes, two of which (at different angles) will exclusively give *instantaneous* readings of the speed over the ground, after Scott's method, on the sole remaining condition that the elevation is known (which on a spacious, comfortable dirigible with a staff of experts can also be more accurately computed).

The sighting gyrotelescope may, after all, acquire still greater importance in making it possible to air light, shell-firing cannon (subsequently machine rifles) with accuracy from the air at the ground. This is much easier than aiming the usual bombs. The speed over the ground does not need to be so accurately known. ("Wind drift" and "momentum deviation," both small, neutralize each other more or less.) The elevation does not need to be known at all if only the barometric height (not that above the ground) is preserved unchanged. Sighting itself is extremely easy, the real task being to steer the aircraft with a gyrotelescope. For this purpose the latter must be mounted on a turntable, (in order to keep it focussed without disturbing its action while the airship in the wind does not point in the direction which it follows with regard to the ground) directly besides the helm which steers right and left. A separate helmsman at the wheel which steers up and down (with eyes rivetted to the variometer) does nothing except maintaining a reasonably unchanged altitude. Slight faults of the variometer (or the gyrotelescope at that) do not affect the sights in firing down when the trajectory curves are so small. It is not difficult to keep the airship in the meantime at an unchanging distance by simply looking at the target through the telescope (keeping it laterally focussed with the aid of the turntable) and so manipulating the right-and-left rudder that the target continues to coincide with the haircross marking the center of the field of sight.

A simple consideration shows that this double steering makes the airship describe the arc of a horizontal circle around the target, unconsciously to the helmsmen compensating any off-drift by the wind. (Heavy Zeppelins steer very accurately.) It is the privilege of aerial "men o' war," that they may freely circle around any land target.

One word suffices in pointing out how quickly simple "spotting" with percussion shells will give to a skilled marksman with a semi-automatic gun deadly accuracy of fire from a great altitude, if only the height and distance of the gun platform remains essentially unchanged.

As it takes a far longer time to get the range of an airship from below, and unlike a bomb-dropping craft directly overhead a dirigible that is firing from a distance cannot be hit if its range is unknown, firing is far safer than bomb dropping, especially as speedy ships maneuver so quickly in and out of range and can make ready while immune. Wholesale destruction may be spread from the air only by conflagration, and it takes only the lightest kind of incendiary shells to start a fire if they are accurately aimed at highly inflammable targets, and can penetrate roofs and walls.

Cadillac
Standard of the World

No car of equal quality can be sold for a price as low as the Cadillac price unless it commands a market as large as the Cadillac market.

IF it were not for the size of the Cadillac clientele, the new Cadillac Eight could not be manufactured and marketed at its present price.

It is too fine in every element that constitutes quality to be distributed in any lesser volume at the present figure.

If its field were limited to five thousand, or even twice that number of purchasers, it would be necessary for the Cadillac Company to advance the price.

A competent engineer, examining the chassis of the new Cadillac Eight, will tell you emphatically that nothing but the large output could possibly justify its superb craftsmanship at so moderate a price.

He will tell you without hesitation that, quite aside from performance, its intrinsic worth is so great that it represents, in the best sense of a much abused word, a value unequaled among motor cars.

Such infinitesimally close and fine mechanical measurements—more than one thousand reduced to an accuracy of one-thousandth of an inch, and more than three hundred to one-half-thousandth of an inch—would be commercially impossible in a car of smaller production.

Cadillac volume *could* be used to attain a lower price with the resulting lesser value. It *is* used, and *always has been* used, to hold down the price and raise the quality higher and higher.

You know how this Cadillac quality expresses itself in the performance of the Cadillac Eight.

"The sweetest running car in the world," it was called a year ago.

And nothing has transpired since to deprive it of that distinction.

The new Cadillac has simply added new lustre to the Cadillac good name.

It is still, as we have often said, "a law unto itself."

Intrinsic-value, performance-value, social-value—in all three it is America's one incomparable motor car.

Styles and Prices

Standard Seven passenger car, Five passenger Salon and Roadster, $2080. Three passenger Victoria, $2400. Five passenger Brougham, $2950. Seven passenger Limousine, $3450. Berlin, $3600. Prices include standard equipment, F. O. B. Detroit.

Cadillac Motor Car Co. Detroit, Mich.

$500,000,000

Anglo-French Five Year 5% External Loan

THE JOINT AND SEVERAL OBLIGATION OF THE GOVERNMENTS OF THE UNITED KINGDOM OF GREAT BRITAIN AND IRELAND AND THE FRENCH REPUBLIC

DATED OCTOBER 15, 1915 DUE OCTOBER 15, 1920 INTEREST PAYABLE APRIL 15 AND OCTOBER 15

Both principal and interest payable in New York City in United States gold coin, without deduction for any present or future British or French taxes

Coupon bonds in denominations $100, $500, and $1000, which may be registered as to principal. Registered bonds in denominations of $1,000, $10,000 and $50,000 and authorized multiples. Coupon and registered bonds interchangeable.

Convertible, at the option of the holder, on any date not later than April 15, 1920, or (provided that notice be given not later than April 15, 1920) at maturity, par for par, into 15-25 Year Joint and Several 4½ per cent. Bonds of the Governments of the United Kingdom of Great Britain and Ireland and the French Republic. Such 4½ per cent. bonds will be payable, principal and interest, in United States gold coin, in New York City, free from deduction for any present or future British or French taxes, will mature October 15, 1940, but will be redeemable, at par and accrued interest, in whole or in part, on any interest date not earlier than October 15, 1930, upon three months' notice.

A large amount of these bonds having already been withdrawn for investment, we, whose names appear below, offer, on behalf of a country-wide group of institutions and bankers, the unsold balance, subject to prior sale and change in price

PRICE 98 AND INTEREST, YIELDING NEARLY 5½ PER CENT.

Payment may be made either in full on October 29th or at the option of the purchaser, 50 per cent. on October 29th and the balance on December 3rd.
Application will be made to list these bonds on the New York Stock Exchange.

Temporary bonds will be ready for delivery on or about October 29th, exchangeable for the definitive bonds when prepared.

ALABAMA

Anniston, First National Bank of Anniston
Birmingham, First National Bank
Otto Marx & Co.

CALIFORNIA

Los Angeles, E. H. Rollins & Sons
San Francisco, E. H. Rollins & Sons
N. W. Halsey & Co.

COLORADO

Denver, Boettcher, Porter & Co.

CONNECTICUT

Bridgeport, Connecticut National Bank
First Bridgeport National Bank
Bridgeport Trust Co.
Hincks Bros. & Co.
Hartford, First National Bank
Hartford-Aetna National Bank
Phoenix National Bank
Connecticut Trust and Safe Deposit Co.
State Bank & Trust Co.
Harris, Forbes & Co.
Kissel, Kinnicutt & Co.
Lee, Higginson & Co.
Montgomery Clothier & Tyler
Rhoades & Co.
New Haven, First National Bank
New Haven Bank, N. B. A.
Second National Bank
The Chas. W. Scranton Co.
White, Weld & Co.

DISTRICT OF COLUMBIA

Washington, Munsey Trust Co.
W. B. Hibbs & Co.

GEORGIA

Atlanta, Trust Company of Georgia
Robinson-Humphrey-Wardlaw-Co.

ILLINOIS

Chicago, Allerton, Greene & King
Breed, Elliott & Harrison
C. F. Childs & Co.
Curtis & Sanger
Hornblower & Weeks
Francis J. Johnspon
Kean, Taylor & Co.
Kissel, Kinnicutt & Co.
Lee, Higginson & Co.
Peabody, Houghteling & Co.
Wm. A. Read & Co.
William Salomon & Co.
Spencer Trask & Co.
White, Weld & Co.

INDIANA

Evansville, Henning Chambers & Co.
Jame C. Wilson & Co.

KENTUCKY

Louisville, United States Trust Co.
Henning Chambers & Co.
James C. Wilson & Co.

LOUISIANA

New Orleans, Hibernia Bank & Trust Co.
Interstate Trust & Banking Co.

MARYLAND

Baltimore, Citizens National Bank
Merchants-Mechanics National Bank
National Bank of Commerce
Baltimore Trust Co.
Maryland Trust Co.
Mercantile Trust & Deposit Co.
Alexander Brown & Sons
Robert Garrett & Sons
Townsend Scott & Son

MAINE

Augusta, Granite National Bank
Augusta Trust Co.
Bangor, First National Bank
Kenduskeag Trust Co.
Merrill Trust Co.
Lewiston, Rumford National Bank
Portland, Canal National Bank
Casco National Bank
First National Bank
Portland National Bank
Fidelity Trust Co.
Forrest City Trust Co.
Mercantile Trust Co.
Union Safe Deposit & Trust Co.
United States Trust Co.
Maynard S. Bird & Co.
H. M. Payson & Co.

MASSACHUSETTS

Attleboro, Attleboro Trust Co.
Boston, Fourth-Atlantic National Bank
Second National Bank
Boston Safe Deposit & Trust Co.
Commonwealth Trust Co.
New England Trust Co
Adams & Co.
Baker, Ayling & Co.
Blake Bros. & Co.
Blodget & Co.
Bond & Goodwin
Wm. P. Bonbright & Co., Inc.
Brown Brothers & Co.
Curtis & Sanger
R. L. Day & Co.
Estabrook & Co.
Hayden, Stone & Co.
N. W. Harris & Co., Inc.
Hornblower & Weeks
Jackson & Curtis
Kidder, Peabody & Co.
A. B. Leach & Co.
Lee, Higginson & Co.
Merrill, Oldham & Co.
F. S. Moseley & Co.
Millett, Roe & Hagen
Moors & Cabot
Parkinson & Burr
Paine, Webber & Co.
Wm. A. Read & Co.
R. H. Rollins & Sons
Spencer Trask & Co.
Stone & Webster
Tucker, Anthony & Co.
Townsend, Anthony & Tyson
H. C. Wainwright & Co.
White, Weld & Co.
Fall River, Massasoit Pocasset National Bank.
Metacomet National Bank
Chace & Stafford
F. O. Dodge
G. M. Hafford & Co.
Fitchburg, Safety Fund National Bank
Lowell, Old Lowell National Bank
James M. Abbott & Co., Inc.
Lynn, Essex Trust Co.
New Bedford, First National Bank
Mechanics National Bank
Merchants National Bank
Newburyport, First National Bank
Merchants National Bank
Ocean National Bank
Pittsfield, Agricultural National Bank
Pittsfield National Bank
F. C. Peach
Salem, Naumkeag Trust Co.
Springfield, Union Trust Co.
W. C. Simons
H. H. Skinner
Tifft Bros. & Co.
Taunton, Machinists National Bank
Taunton National Bank
Worcester, Bonney & Moore
Kinsley & Adams

MICHIGAN

Detroit, First and Old Detroit National Bank
Wm. P. Bonbright & Co., Inc.
Grand Rapids, Old National Bank
Michigan Trust Co.

MINNESOTA

Minneapolis, First & Security National Bank
Northwestern National Bank
Scandanavian-American National Bank
St. Paul, First National Bank
Northwestern Trust Co.

MISSOURI

St. Louis, A. G. Edwards & Sons
Francis Bros. & Co.

NEBRASKA

Omaha, Burns, Brinker & Co.

NEW HAMPSHIRE

Concord, Mechanics' National Bank
Dover, Strafford National Bank
Manchester, Alonzo Elliott & Co.
Shontell & Varick

NEW JERSEY

Newark, J. S. Rippel

NEW YORK

Albany, First National Bank
National Commercial Bank
New York State National Bank
Union Trust Co.
Harris, Forbes & Co.
Spencer Trask & Co.
Binghamton, Peoples' Trust Co.
Buffalo, Bank of Buffalo
Ford & Enos
Harris, Forbes & Co.
White, Weld & Co.
Elmira, Sawyer, Noble & Co.
Middletown, Merchants National Bank
New York City, J. P. Morgan & Co.
American Exchange National Bank
Bank of America
Bank of New York
Chemical National Bank
Chase National Bank
First National Bank
Hanover National Bank
Importers & Traders National Bank
Irving National Bank
Liberty National Bank
Manhattan Co.
Mechanics & Metals National Bank
Merchants National Bank
National Bank of Commerce
National City Bank
National Park Bank
Seaboard National Bank
Bankers Trust Co.
Central Trust Co.
Columbia Trust Co.
Equitable Trust Co.
Farmers Loan & Trust Co.
Guaranty Trust Co.
Metropolitan Trust Co.
New York Trust Co.
Title Guarantee & Trust Co.
Union Trust Co.
United States Mortgage & Trust Co.
United States Trust Co.
August Belmont & Co.
Chas. D. Barney & Co.
Blair & Co.
William P. Bonbright & Co., Inc.
Brown Brothers & Co.
Clark, Dodge & Co.
Harvey Fisk & Sons
Heidelbach, Ickelheimer & Co.
Haligarten & Co.
N. W. Halsey & Co.
Harris, Forbes & Co.
A. Iselin & Co.
Kean, Taylor & Co.
Kidder, Peabody & Co.
Kissel, Kinnicutt & Co.

New York City—Continued
Kountze Bros.
Lazard Freres
A. B. Leach & Co.
Lee, Higginson & Co.
Ladenburg, Thalmann & Co.
Maitland, Coppell & Co.
Montgomery, Clothier & Tyler
Potter, Choate & Prentice
Wm. A. Read & Co.
Redmond & Co.
Remick, Hodges & Co.
Rhoades & Co.
William Salomon & Co.
J. & W. Seligman & Co.
Spencer Trask & Co.
White, Weld & Co.
Rochester, Alliance Bank
Traders' Bank of Rochester
Security Trust Co.
Ford & Enos
Harris, Forbes & Co.
Syracuse, Ford & Enos
Troy, Troy Trust Co.
Harris, Forbes & Co.

OHIO

Cincinnati, Citizens National Bank
First National Bank
Cleveland, The Bonbright-Herrick Co.
Harris, Forbes & Co.
Hayden, Miller & Co.
Otis & Co.
The Tillotson & Wolcott Co.
White, Weld & Co.
Columbus, Huntington National Bank
Dayton, City National Bank
Toledo, Second National Bank
Secor & Bell

OREGON

Portland, Hall & Lewis

PENNSYLVANIA

Philadelphia, Drexel & Co
Brown Brothers & Co.
Bank of North America
Central National Bank
Corn Exchange National Bank
First National Bank
Fourth Street National Bank
Franklin National Bank
Philadelphia National Bank
Commercial Trust Co.
Fidelity Trust Co.
Girard Trust Co.
Pennsylvania Co. for Insurance on Lives and Granting Annuities
Barclay, Moore & Co.
Charles D. Barney & Co.
Battles & Co.
C. H. Bean & Co.
Benson & Packard
Thomas A. Biddle & Co.
Bodine Sons & Co.
William P. Bonbright & Co., Inc.
Brooke, Stokes & Co.
Butcher, Sherrerd & Hansell
Cassatt & Co.
E. W. Clark & Co.
Coles & Wurts
Elkins, Morris & Co.
Ervin & Co.
Charles Fearon & Co.
Frazier & Co.
M. M. Freeman & Co.
Robt. Glendinning & Co.
Goodall, Wister & Co.
Graham & Co.
N. W. Halsey & Co.
Harper & Turner
Harris, Forbes & Co.
Chas. C. Harrison, Jr., & Co.
Henry & West

Philadelphia—Continued.
C. Clothier Jones & Co.
Klemm & Keen
A. B. Leach & Co.
Mellor & Petry
Montgomery, Clothier & Tyler
W. H. Newbold's Son & Co.
Wm. A. Read & Co.
Reilly, Brock & Co.
E. B. Smith & Co.
J. W. Sparks & Co.
E. Lowber Stokes
Townsend, Whelen & Co.
Rufus Waples & Co.
Pittsburgh, Bank of Pittsburgh, N. A.
Diamond National Bank
Farmers Deposit National Bank
First-Second National Bank
Mellon National Bank
Peoples National Bank
Union National Bank
Western National Bank
Colonial Trust Co.
Pittsburgh Trust Co.
Safe Deposit & Trust Co.
Union Trust Co.
Holmes, Wardrop & Co.
Montgomery, Clothier & Tyler
Scranton, Brooks & Co.

RHODE ISLAND

Newport, Aquidneck National Bank
Pawtucket, Slater Trust Co.
Providence, Columbus Exchange National Bank
Merchants National Bank
National Exchange Bank
Providence National Bank
Industrial Trust Co.
Rhode Island Hospital Trust Co.
Bodell & Co.
Richardson & Clark
Wilson, Slade & Co.
Westerly, Washington Trust Co.

SOUTH CAROLINA

Charleston, First National Bank
A. M. Marshall & Bro.
The E. M. Moreland Co.

TENNESSEE

Nashville, Fourth-First National Bank

VERMONT

Brattleboro, Brattleboro Trust Co.
Montpelier, Montpelier National Bank
Rutland, Clement National Bank

VIRGINIA

Richmond, American National Bank
Bank of Commerce & Trust
First National Bank
Mechanics & Merchants National Bank
Merchants National Bank
National State & City Bank
Planters National Bank
Old Dominion Trust Co.
Richmond Bank & Trust Co.
Richmond Trust & Savings Co.
Virginia Trust Co.
Thomas Branch & Co.
Davenport & Co.
Scott & Stringfellow
John L. Williams & Sons

WASHINGTON

Seattle, E. H. Rollins & Sons
Spokane, Richards Bros.
Tacoma, E. H. Rollins & Sons

WISCONSIN

Milwaukee, Edgar, Ricker & Co.